Energy Alternatives

Surveying the Territory

THE CORNER HOUSE


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May 2013

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Published by The Corner House in collaboration with Hnuti DUHA–Friends of the Earth Czech Republic, CEE Bankwatch Network, Les Amis de la Terre-Friends of the Earth France, Re:Common and urgewald e.V.

Many thanks to everyone who contributed and commented.

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Printed on recycled paper by RAP Spiderweb Ltd, Clowes Street, Hollinwood, Oldham, Manchester OL9 7LY, UK. www.rapspiderweb.com

This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of The Corner House and can in no way be taken to reflect the views of the European Union.

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The Diversity of Energy Alternatives

What with a growing climate crisis and increasing uncertainty over the future of fossil fuels, it can be no surprise that the question "What's the alternative to current energy systems?" is in the air. And there has been no shortage of answers competing for space and attention. In energy policy today, the main conflict is not between energy business as usual and "The Alternative", but among the different proposed alternatives themselves.

What are these different alternatives? What kind of changes are being proposed? Who would bring them about, and how? Where is the conflict among different energy alternatives going? Where might activists intervene most strategically to build alliances to bring about the changes in energy systems that are necessary – as well as to oppose initiatives that will only make things worse?

It is hard even to survey this territory. The problem is not just that the suggested solutions are diverse. The questions being asked are also different, as are the criteria for answering them, the vocabularies in which they are expressed, and the politics with which they are associated. Figuring out what the assumptions and audiences of the various alternatives are is half the work of assessing where a democratic and survivable energy future might lie. The point of this report is not to simplify the debate over energy alternatives, but to clarify how complex it is. If the need for action is urgent, then so is the need for an understanding capable of making that action effective.

A Sense of the Territory

As a start on answering these questions, a sample of energy alternatives proposals and the questions they address is displayed over the following pages, roughly and naively divided according to whether the proposals appear global (Table 1), national (Table 2) or local or individual (Table 3) in scope.

The sample is tiny. It does not pretend to be representative. But it is diverse enough to suggest how hard it is to understand what the alternative energy debate is about and how hard it might be to make it possible for everyone who is interested to participate.

Table 1

"Global"- Level Proposals and Initiatives

MAIN QUESTIONS ADDRESSED	AUDIENCES ADDRESSED	PROPOSAL OR INITIATIVE
Given the threat that fossil fuels pose to a stable climate, as well as their declining availability, can alternative, non-nuclear sources be found that provide the same amount of usable energy demanded by a fossil-dependent system equally cheaply and in an equally convenient way?	Imaginary global energy planners	Wind, water and sunlight could provide electricity and electrolytic hydrogen "for all purposes" worldwide by 2030 at no extra cost, using only one per cent more of the earth's land surface than currently occupied by energy-related installations (Jacobson and Delucchi, 2011)[1]
What is the minimum amount of energy required to power industrial processes, cars, buildings and so forth? How could this energy be supplied in a sustainable way? In particular, how much could the use of fossil fuels and nuclear energy (which now provide more than 80 per cent of total world energy) be reduced by 2050 assuming continued growth in industrial output and freight transport?	Imaginary global energy planners	Through end-use energy savings, further electrification and replacement of traditional with renewable energy sources, everyone on the planet could be supplied with the energy they need by 2050 using 95 per cent renewable sources, reducing greenhouse gas emissions from the energy sector by 80 per cent, at a net cost of 2 per cent of global GDP or less annually (World Wide Fund for Nature/Ecofys, 2011)[2]
Is it possible to transform the way the world produces, consumes and distributes energy, while maintaining economic growth, protecting the world from catastrophic climate change by phasing out fossil fuels, and ensuring "energy security for growing economies and populations"?	Imaginary global energy planners	Energy efficiency combined with a major expansion of renewable energy technologies, including both decentralised local grids and large power plants connected to new supergrids, could "reduce energy related CO_2 emissions to a maximum of 3.5 gigatonnes by 2050 and phase out over 80 per cent of fossil fuels by 2050", while maintaining economic growth, avoiding nuclear power, and providing energy "to the two billion people currently without access to energy services". Global energy consumption would be stablized "within the next two decades",[3] while efficiency would reduce overall primary energy demand in 2050 to 40 per cent of today's. By 2050, "almost the entire global electricity supply, including the majority of the energy used in buildings and industry," would come from renewables, for the use of which binding targets would be set. Subsidies for fossil and nuclear energy would be phased out and the social and environmental costs of energy production "internalized" through emissions trading (Greenpeace, 2012)[4]

MAIN QUESTIONS ADDRESSED	AUDIENCES ADDRESSED	PROPOSAL OR INITIATIVE
How much efficiency in fossil fuel use could be achieved by 2035 through "economically-viable" market-oriented policies (including a phaseout of most fossil-fuel subsidies) that assume no major or unexpected technological breakthroughs, no holistic approaches (such as prioritising energy efficiency at all levels of urban planning), and no changes in consumer behaviour (except where induced by lower energy prices)?	Imaginary global energy planners, national governments	Energy efficiency could cut growth in global primary energy demand to 2035 by half and lower oil demand by 13 million barrels a day, buying five years of time to halt current patterns of fossil-intensive energy infrastructure development (International Energy Agency [IEA], 2012)[5]
Assuming current technologies, how could a doubling of atmospheric concentrations of carbon dioxide be avoided for the next 50 years?	Energy planners, academics	Fifteen technological strategies – including improving the efficiency of vehicles, buildings and coal-fired power plants; reducing vehicle use; increasing nuclear capacity, wind and hydrogen capacity; growing new tree plantations and improving tillage – could each reduce carbon dioxide emissions by one billion tonnes a year (Pacala and Socolow, 2004)[6]
Assuming that water and food security, improved health care and education and secure livelihoods can be provided for the world's deprived peoples only through a "dramatic expansion of access to energy services", and that access to energy services has historically implied the appropriation of scarce "atmospheric space" in which to dump greenhouse gases (a space that must be understood as quickly disappearing if a climate crisis is to be avoided), how can action to correct global inequities be squared with action on climate change?	United Nations delegations, governments, academics	North and South could negotiate a way of equitably sharing any remaining atmospheric space (the carbon budget) and of compensating for historical Northern overuse of that space; this will be possible only if the North agrees to develop and use technical means of economising on that space and pay out large sums for the adoption of those means in the South as well, in a way that allows for vastly increased use of "energy services" there (EcoEquity and Stockholm Environment Institute, 2012)[7]

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Table 1

(continued)

MAIN QUESTIONS ADDRESSED	AUDIENCES ADDRESSED	PROPOSAL OR INITIATIVE
How might a fair transition to renewable energy become politically possible?	Trade unions, union-friendly governments, popular movements	Restructuring the global energy system to reduce demand, decentralize generation and decarbonize supply requires resisting the agenda of the dominant energy corporations and – using public finance – reclaiming the energy economy for the public sphere (Trade Union Energy Emergency Transition, 2012)[8]
How can over-consumption be combatted, and environmental protection and prosperity for all ensured, while still maintaining private property, a "free market" and a corporate-dominated society?	Imaginary independent global regulator-economists	Greater concern with "flourishing" rather than profits could inform a new "model" for reprogramming the economy to regulate "throughput" and excise the accumulation imperative from capitalism, allowing a stable or no-growth economy and an escape from the "iron cage" of consumerism (Daly, 1989, 1991, 1996; Jackson, 2011)[9]
How can "present levels of production and consumption and resource use" be reduced?	Imaginary regulators, popular movements, progressive governments	A "sustainable and just world order" requires a change to "simpler lifestyles", "small, highly self-sufficient local economies largely independent of the global economy", "more cooperative and participatory ways", a "new economy . . . not driven by profit or market forces" and "different values" of "cooperation" and "frugality" (Trainer, 2012)[10]
How can the crisis caused by the unrestricted use and unequal distribution of fossil fuel-based energy be countered?	Popular movements, progressive Southern governments	A decentralized, regionalized solar economy will follow the trail blazed by *buen vivir* (the Latin American principle of "good living" via commons) and will approach energy as a social, political and historical phenomenon, a tool for building justice and the transfer of wealth; post-extractivism is a necessary part of a post-oil civilization, as are plural, anti-authoritarian sovereignties in food and finance as well as energy (Acosta, 2012)[11]

Table 2

"Regional" or "National"- Level Proposals and Initiatives

MAIN QUESTIONS ADDRESSED	AUDIENCES ADDRESSED	PROPOSAL OR INITIATIVE
Is it possible to provide for the European Union's energy needs without nuclear or fossil fuels, whilst still maintaining growth?	Imaginary European Union energy planners	It is possible to formulate a "pathway towards a 100 per cent renewable energy supply system by 2050" for "electricity, heating and cooling as well as transport" throughout all member states of the European Union. The challenge lies not in a lack of available technologies but in how to make the right "enabling" policy changes: reducing demand; expanding renewable energy capacity tenfold; properly mixing hydropower, wind, photovoltaics, biomass, geothermal, concentrated solar power and wave power; phasing out all subsidies for fossil and nuclear energy; introducing an EU-wide carbon and energy tax; and liberalizing the energy market. Non-renewable resources would still supply fuel for aviation and inland navigation (European Renewable Energy Council [EREC], 2010)[12]
Could alternative sources of energy in the United States be combined with a programme of reduction of consumption of energy and energy efficiency in a way that sustains domestic rates of profit?	Big business, business-friendly governments, consumer households	The US economy could grow by 158 per cent by 2050 without coal, oil, or nuclear energy, and with one-third less natural gas, reducing greenhouse gas emissions by over 80 per cent, assuming efficiency improvements and using intelligently-regulated market mechanisms (Rocky Mountain Institute [RMI])[13]
Would it be possible to ensure 24-hour-a-day security of energy supply for Germany in 2050 using only renewable sources? At what cost? What instruments are necessary to support a transition? Are bridging technologies other than energy efficiency measures required?	Government	Given various assumptions about demand growth and the proportion of energy imported from other countries, renewable sources, particularly wind and solar, are capable of providing all of German demand at a cost lower than that of conventional low-carbon sources, given a reasonable carbon price, without the need to build transitional coal-fired plants with carbon capture and storage or to extend the life of nuclear power plants (German Advisory Council on the Environment [GACE], 2011)[14]

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Table 2

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MAIN QUESTIONS ADDRESSED	AUDIENCES ADDRESSED	PROPOSAL OR INITIATIVE
Is a completely renewable electricity sector for countries such as New Zealand or the United States feasible, achievable, and desirable?	Imaginary national energy planners	Both New Zealand and the US could achieve a renewable power sector by 2020; the New Zealand government has already set a voluntary target of 90 percent renewable power supply by 2025 (Sovacool and Watts, 2009)[15]
Could Britain maintain its current energy consumption on sustainable energy alone? What are the elements of a realistic post-carbon national energy plan? Would it be possible for the UK to tackle climate change without eliminating industrial civilization and middle-class comforts?	Imaginary national energy planners	Renewable energy could meet only about 15 per cent of current UK energy consumption in the transport, heating and electricity sectors; reducing carbon dioxide emissions entails blanketing the country with wind, nuclear, clean coal and biofuel installations and probably importing solar power from North Africa; "for any renewable facility to make a contribution comparable to our current consumption, it has to be country-sized" (MacKay, 2009)[16] UK heat and electricity demand could be reduced by over half by 2030 through new non-nuclear technology, while new technologies including offshore wind and wave energy come on line and more efficient design and behaviour and lifestyle changes take hold, reducing carbon emissions (Zero Carbon Britain, 2010)[17] The UK could cut 90 per cent of its carbon emissions by 2030 through transformation of homes and power and transport systems – and, through better regulation, enhance the freedoms of its residents (Monbiot, 2006)[18]
How could massive financial resources that are currently wasted due to inherent flaws in market mechanisms and non-market social failures, as well as to subsidies for the US military, be used instead to address climate change?	Governments, popular movements	Tackling inequality, lack of democracy and misguided foreign policy are components and results of an activist, public investment approach that could phase out more than 90 per cent of US greenhouse gas emissions over 20 years at a cost of less than US$244 billion per year, or at a profit if health and productivity benefits and the like are included (Lipow, 2012)[19]

MAIN QUESTIONS ADDRESSED	AUDIENCES ADDRESSED	PROPOSAL OR INITIATIVE
What kind of national power development plan for Thailand could reverse a trend toward increased destruction of rural livelihoods (and rural energies) by centralized generating projects? How can an energy planning tradition be countered that is marked by a history of US anti-insurgency concerns, grossly inflated demand projections, overcapacity, growing energy intensity – and, more recently, increasingly privatized energy institutions bent on even more construction for financial reasons?	Energy planners, popular and community movements	Even with a 15 per cent reserve margin, an alternative power development plan that prioritized investment in energy efficiency, demand-side management, extension of the life of some power plants and other measures could make investment in new supply for Thailand – including renewable supply – unnecessary for many years (Palang Thai, 2012)[20]
What measures could be taken in the UK to tackle both economic and climate crises in a way that put workers at the centre?	Trade unions, popular movements, government	A National Climate Service employing one million people in need of jobs could cut carbon dioxide emissions by 80 per cent in 20 years while doubling electricity supplies, for less money than the government gave large banks during the 2008 financial crash, and with far more beneficial knock-on effects and additional indirect job creation (Neale, 2010)[21]
Assuming that total UK emissions (including aviation and shipping) peak in 2014, how can the emission reductions of the order of 6–9 per cent per year (8–11 per cent per year in terms of carbon intensity) be achieved that are necessary if the UK is to play its part in the commitment to limit temperature increases to 2 degrees Celsius?	Hypothetical independent regulator-scientists, concerned citizens	Only by tackling energy demand in the very short term, and energy demand and supply in the longer term will the UK be able to achieve the emissions reductions necessary to address climate change; the current focus on long-term mitigation targets and supply development is misguided (Anderson, Bows and Mander, 2009)[22]

Table 3

"Local"- or "Individual"-Level Proposals and Initiatives

MAIN QUESTIONS ADDRESSED	AUDIENCES ADDRESSED	PROPOSAL OR INITIATIVE
How can the century-long tradition of locally-controlled wind power in Denmark continue to be mobilized in connection with the transition from fossil fuels which became a national concern beginning with the 1970s oil crises?	Community movements, government	Incubated through a long, dynamic history of cooperative local research and production, windmill technology now produces more than 100 per cent of local power consumption in some areas of Denmark and can provide half the country's electricity on windy days; key to the success and acceptance of wind have been community ownership, guaranteed prices for pollution-free energy, and deliberate restrictions on its commodification: windmills originally had to be owned locally, with private shareholding proportional to a household's private consumption and farmers entitled to install one turbine on their land; with neoliberal legal reforms having increased large-scale outside ownership, making wind a financial investment competing with fossil fuels and no longer tied to local cooperatives, public involvement in wind has decreased, meaning that the future of the alternative depends on political change (Maegaard, 2010)[23]
Is it possible to evolve a popular plan for alternative development for Thailand's coastal Prachuab Khiri Khan province that can avoid planned new coal-fired electric power and steel developments?	Popular and community movements, governments	Building on the 10-year success of local resistance to planned coal-fired electric power plants is one part of the process of evolving a just provincial-level programme for defence of local subsistence and prosperity through rice, coconut and pineapple cultivation, local marketing, small fisheries, tourism, and wind and other non-fossil energy sources. Opposition to Thailand's official Southern Seaboard development plan is an integral part of this alternative, which also constitutes a durable response to climate change (Sureerat, 2010)[24]

MAIN QUESTIONS ADDRESSED	AUDIENCES ADDRESSED	PROPOSAL OR INITIATIVE
How can communities affected by oil extraction in Ecuador cope with challenges connected with energy and the evolution toward a post-oil civilization, especially in view of the prospect of having to absorb a possible US$18 billion in reparations from oil companies for damage to the land between the 1960s and 1990? How can the campaign to keep oil in the soil be seen as part of a larger movement for a post-oil civilization?	Community groups, activists, governments	Reweaving the social fabrics of community life involves local-specific processes of developing a staged set of initiatives addressing interlinked issues of health, family violence, alcoholism, agriculture, learning, transport and the evolution of oil-free territories (Clinica Ambiental, 2012)[25]
Given a deepening climate crisis, what is the alternative to conventional theories of collective action that place heavy reliance on global solutions and international negotiations? Does the global nature of climate change mean a single governance unit is sufficient to tackle the issue? Instead of focusing entirely on the vital, but so-far unproductive means of international treaties, should more attention be paid to self-organized systems at different levels?	Academics, governments	Approaches at "non-global" levels, many of them already in existence, encourage experimentation and learning and help benefits from global warming action to be achieved at multiple scales; building commitments to reducing individual emissions can be more effectively undertaken in small- to medium-scale units that are linked together through diverse information networks; while "free-riding" is a problem, it is also a problem with global treaties (Ostrom, 2010)[26]
How can communities in Europe develop independent approaches toward a transition to clean energy and a better life?	Community groups, activists, governments	Energy Descent Action Plans can be developed by "Transition Towns" that do not assume the need for economic growth, cheap energy, more cars, and so on, and that emerge dynamically from specific UK communities through a process that involves storytelling about the future and attention to local pathways (Hopkins, 2011)[27]

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Table 3

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MAIN QUESTIONS ADDRESSED	AUDIENCES ADDRESSED	PROPOSAL OR INITIATIVE
How can existing local low-carbon energy alternatives be defended and developed?	Popular movements, governments	In the Pgakenyaw community of Huay Hin Lad in the northern Thai province of Chiang Raai, rotating and paddy agriculture and community forest protection ensure that a mere 0.08 per cent of carbon stored in the locality is emitted per year, with villagers' land footprint amounting to 0.61 hectare per capita (compared to a Thai average of 1.7 and a US figure of 9); maintaining and further developing this alternative requires that attacks on the rights of highlanders be stopped, including those associated with expansion of national parks and assaults on local agricultural practices, indigenous knowledge and communal land tenure (Northern Development Foundation, [NDF], 2012)[28]
How can individuals in Britain reduce their carbon dioxide emissions to 3 tonnes a year as a more effective alternative to government inaction and the inefficacy of price mechanisms? How can they create low-carbon action plans that make possible more satisfying lives?	Individuals	Individual decisions to heat homes more effectively, eliminate flying, etc. could be an "early part" of a more successful climate movement (Goodall, 2007)[29] Individuals could find numerous ways of "dropping tonnes" from their emissions and have more fun and socially-connected lives in the process (Marshall, 2007)[30]

Four Differences:
What They Might Mean for Action

Tables 1-3 should shame into thoughtful silence all who have ever challenged a critic of fossil-fuelled energy systems with the dismissive question "What's the alternative?", and induce in them a contrite resolve never to ask such a question again. As the tables show, there is no shortage of detailed, creative, even inspiring initiatives for moving away from fossil fuels.

But as the tables also show, the questions that these initiatives ask, the assumptions they make, and the interests they seek to serve are bewilderingly diverse. There may not be a lack of alternatives, but there is clearly a lack of a framework to make sense of them and discuss them in a democratic way. If the many divergent conversations about "energy alternatives" being carried on globally are to be brought together, analytically or politically, their points of difference and conflict as well as their possible areas of synergy must be recognized and mapped. To support uncritically any and all initiatives that describe themselves as "energy alternatives" would be to invite chaos and unending conflict – as well as making impossible a livable energy future.

There is no lack of energy alternatives – but clearly a lack of a framework to make sense of them.

Using the tables as a starting point, this report will sketch four crucial differences among leading types of energy alternative:

- Different alternative proposals and initiatives are organized around different questions and audiences.
- They rely on different conceptions of energy's historical and social entanglements.
- They follow different political theories and processes.
- They have different understandings of the relationship between the local and the global.

The report will then take up each of these four divides in turn, developing examples from the tables and elsewhere.

The report will end by exploring how – under these conditions of radical and contradictory diversity – activists might best encourage the democratic dialogue and alliance-building that constitutes the most important aspect of effective action toward a survivable energy future.

First Divide: Different Questions, Different Debates

The variety of the questions being asked is the most obvious feature of Tables 1-3 and a good general starting point. While some questions are shared among two or more initiatives, many are not. The more important differences among the proposals are not that they give contrasting answers to the same question, but that they ask different questions. It seems there is no single debate about energy alternatives in which all parties in the tables are participating, but rather many debates about different topics.

A great many initiatives, for example, appear to start from the question of how to ensure that, with less fossil fuel use, fewer emissions and less environmental destruction generally, a comparable amount of thermodynamic work could continue to be done by the machines of industrialized societies in the production and consumption of commodities. Sometimes this question takes the form of a quest for a carbon-free or low-carbon replacement for fossil fuels that would leave everything else more or less as it is (Jacobson and Delucchi; WWF; IEA; Socolow and Pacala; GACE; Sovacool and Watts; MacKay; Zero Carbon Britain; RMI; Monbiot). Many alternatives proposals assume that, in a low-carbon world, the economic growth rates to which fossil fuels have accustomed the industrialized world must be held constant.

Other proposals add that the global distribution of the benefits of industrialism must also be managed, using international agreements (EcoEquity and Stockholm Environmental Institute; Trade Union Energy Emergency Transition; Neale; Lipow). Still others, while maintaining a concern with industrial productivity, would manage growth also, postulating an input-regulated, steady-state capitalism of reduced business profits as a necessary ingredient of an energy alternative (Daly; Jackson). In some proposals, the question of how to provide alternative energy supplies for a given industrial system is even more explicitly subordinated to the question of how to limit energy demand (Anderson, Bows and Mander). A few proposals, meanwhile, ask how the capacity to provide the thermodynamic work necessary for a continuation of business as usual could be maintained without expanding destructive energy infrastructure, but do so "tactically", leaving open the possibility of formulating more thoroughgoing alternatives in the future (Palang Thai).

A different strain of proposals is less interested in the question of how to preserve some form of industrialism through low- or no-carbon energy supplies or through demand management. Some focus narrowly on the need to regulate greenhouse gas emissions in the short term regardless of the fate of industrial machine use and business profits (Anderson, Bows and Mander). Others, more radically, call for, or explore possibilities for, a post-fossil-fuel civilization in a way that explicitly questions the flows

of energy and value characteristic of industrialism (Trainer; Acosta; Clinica Ambiental). Without taking an explicit view on industrialism in general, still others start from the question of how best to defend local livelihoods, welfare and independence at a time when both fossil fuel extraction and burning is increasing and the climate crisis is worsening (Sureerat); or ask what the costs of neglecting existing local practices might be to the search for energy alternatives (NDF). Then there are initiatives rooted in local efforts to counter fossil fuel dependence that have broadened out in ways that also address a multitude of other questions (Maegaard, Hopkins).

The questions that various initiatives discuss differ also in to whom they are addressed. Sometimes the audience is difficult to identify and rather mysterious. As they stand, for example, the questions tackled by many academics, NGOs and journalists – such as Jacobson and Delucchi, WWF, Greenpeace, Socolow and Pacala, Daly, Jackson, EcoEquity, MacKay, Zero Carbon Britain, Monbiot, and Sovacool and Watts – might be suitable for discussion among a class of hypothetical independent, impartial, supremely powerful global or national regulators. But for such questions to be taken seriously by actually-existing, more politically-constrained actors, they would need to be supplemented by additional questions about what the strategic programme might be for them in particular, and what processes of change they might adopt. That is, the question "What energy alternatives would you implement if you were all-powerful?" (which provides the implicit framework for the proposals above) would need to be supplemented with the query "how might various actually-existing political actors strategically use the answers to this question given that they are not all-powerful?". To put it yet another way, the unclear identification of the audience for these proposals – or, rather, their implicit identification of an audience that turns out not to exist – makes the questions that they pose, and thus the answers they canvass, radically incomplete, unanchored, and somewhat ghostly. All are more in the nature of thought-experiments than concrete, realistic political proposals.

The nature of the audience to which many proposed alternatives are addressed is somewhat mysterious.

A sharp contrast is offered by the questions raised by, for example, Acosta, Palang Thai, Maegaard, Sureerat, Clinica Ambiental, Hopkins, the Northern Development Foundation, Goodall and Marshall. Because the audiences addressed by these initiatives are more clearly delineated, the questions they tackle are more strongly-grounded politically and less ambiguous in how they can be interpreted and otherwise acted upon by interested parties. The NDF initiative, for example, grows out of, and responds to, the struggle of a specific set of communities defending their low-carbon shifting agriculture and communal forest practices against clearly-identified antagonists among Thai government agencies and conservationists. Because it is clear about its audience among the parties to this struggle as well as among a wider popular climate movement, the initiative's questions lead to clear points for action among real-life political actors in a way that helps open up unambiguously positive practical possibilities in the development of energy alternatives.

By the same token, the Palang Thai proposal for an alternative power development plan for Thailand is designed to serve a particular set of political actors with long experience of defending local livelihoods

and the public interest against a privatising energy bureaucracy bent on extending a tradition of construction of massive overcapacity. The questions it asks thus lead to answers capable of turning political gears in ways that, say, the alternative plan for the US offered by thinkers such as Sovacool and Watts, or for the world by organizations such as WWF, cannot. Like the Danish wind-energy communities described by Maegaard, Palang Thai, because of the way it clearly identifies and works with its audience, cannot avoid asking practical questions about neoliberalism and processes of social change as well as about kilojoules and transmission lines, making its overall approach to alternative energy more substantial and richly-textured than that of more abstractly-addressed proposals with which it may share some formal styles of analysis. Even the proposal of EcoEquity and the Stockholm Environmental Institute, in identifying negotiators from the global South as a key audience, is able to take on a range of questions concerning equity and political process that are absent from the more free-floating treatments of academic theorists like Jacobson and Delucchi or Socolow and Pacala.

Of course, the initiatives listed in the tables also differ markedly among themselves in what they think the audience for energy alternatives proposals should be. According to the late Elinor Ostrom (Table 3), a scholar of commons regimes who won the Nobel Memorial Prize for Economic Sciences in 2009, mainstream political science assumes that the only way to tackle crises of global scope, such as those surrounding climate change, energy and fossil fuels, is through international negotiations.[31] Some think-tanks and large NGOs, particularly in the North, follow this doctrine to the letter – often so stubbornly, indeed, that, as noted above, if effective global actors are not present, they still do research and write proposals as if they were. Yet, as Tables 2 and 3 demonstrate, independent actions can be, and are being, undertaken by communities and local and national governments as well as individuals. And as Ostrom observes, such actions are often more effective than, and will always be effective in different ways from, those taken through international treaties.

Who are likely to be the main agents of an energy transition? Trade unions? Governments? Large corporations? Consumers? The United Nations? Opinions differ sharply.

Controversy is bound to continue at other levels as well over what constitute the most appropriate units of analysis and action for particular objectives at particular times. Trade union climate initiatives, for example, stress that the leadership of working people is crucial and that the defence of their interests central (Trade Union Energy Emergency Transition [Table 1], Neale [Table 2]). Governments of a neoliberal bent, by contrast, seek ways of turning the job of energy transition over to large corporations. Some European climate writers and activists such as Chris Goodall and George Marshall (Table 3), meanwhile, see action by individual consumers and householders (for instance, shrinking personal "carbon footprints") as a key basis for a larger and more wide-ranging climate movement at a time of frustrating institutional paralysis. Yet environmental columnist and author George Monbiot (Table 2) argues that individuals will have the freedom to make the difference they want to make only if overall government regulation improves – through, for example, requiring property developers to follow energy-efficiency

standards in refurbishing houses, so that homebuyers are given more energy-saving choices.[32] Taking a different tack, David MacKay, Chief Scientific Adviser to the UK Department of Energy and Climate Change (Table 2), cautions against the "every little helps" mentality that drives some personal carbon-saving programmes, claiming that "what's required are big changes in demand and in supply."[33] As will be explored below, in addition, categories like "individual", "local", "national" and "global" are themselves unclear and contested.

A final category of difference among the proposals of Tables 1-3 is in the details of their presuppositions. Some take it for granted that the question of energy alternatives is a question of supply (Neale); others argue that it is primarily a question of cutting energy use (Anderson, Bows and Mander); still others argue it is more a question of societal metabolism or good living (Acosta). Some are optimistic about the potential for renewable energy to meet the demand of industrialized societies (Sovacool and Watts), others less so (MacKay). Some assume that price mechanisms are effective agents of structural change (Jacobson and Delucchi); others do not (Clinica Ambiental). Some allow for nuclear energy (Socolow and Pacala); others exclude it (Greenpeace, EREC, RMI). Some countenance the capture and storage of carbon dioxide from power plants (Monbiot); others do not (Lipow). Some presuppose continued economic expansion (IEA); others are more than happy to question it (Jackson).

Opinions are also divided about whether price increases could bring about the changes that are needed.

What does the existence of all of these differences say about the possibility for effective alliance-building around energy alternatives? To what extent might these differences be resolved or reconciled? If they cannot be overcome, what are the lessons for political action?

It is obvious at first glance that the contradictions are severe and run deep. But a fuller answer to these questions will only be possible through a more thorough exploration of the differences among today's "energy alternatives". That will be the job of the next three sections.

Second Divide: Simplifications and Entanglements

One striking feature of Tables 1-3 is that in the descent from Table 1 to Table 3, and even to an extent from top to bottom within each table, the questions addressed tend to multiply in number, expand in complexity, and become more visibly entangled with other questions in which the contemporary concept of "energy" is less prominent.

For example, many of the proposals in Tables 1 and 2 take the overall form of highly-simplified exercises matching two abstractions: attempts must be made to find supplies of renewable or no-carbon energy to meet a given aggregate demand or set of end uses. Some proposals vary the exercise slightly by also treating demand, or energy use, as a variable to be managed. On this view, energy alternative proposals face dual requirements: on the one hand to increase renewable energy supplies, and on the other to decrease energy use to match a supply constrained by a "carbon budget", "limits on throughput" or the earth's "limits" or "carrying capacity". Among the means often invoked to curb energy use are efficiency measures, restraints on consumption and population control.

Such "matching exercises" tend to be most at home in institutions charged with global or national planning or university departments of economics, engineering or science, but they are also popular among NGOs and activists. Significantly, while the two things that are to be matched – supply and demand – have both been largely determined by the history of fossil fuel development, the words "coal", "oil" and "gas" often drop out of sight in these matching exercises, whose simplified, abstract nature is closely connected with the lazy temptation to treat fossil fuel use as a mere incidental, or detachable, part of industrial society. A blog from US energy expert David Roberts provides one example:

> "The level of energy use in an economy is the result of two factors: how big the economy is and its 'energy intensity,' i.e., how much energy is required to produce a unit of GDP. Multiply an economy's size by its energy intensity and you get the amount of energy it uses. If an economy is growing at a faster rate than its energy intensity is falling, then total energy use will rise. If, however, an economy's energy intensity falls at a *faster* rate than it is growing, total energy use will decline. Make sense?"[34]

Reducing energy use, Roberts continues, can be accomplished in two ways: by driving down global energy intensity or by driving down global economic growth.

> "It is a simple matter of math to say that the more you do of any one of these [increase supply of low-carbon energy, reduce energy intensity, or reduce growth], the less you have to do of the others. If we could . . . replace the entire global energy supply with low-carbon power tomorrow, we could grow as fast as we want and there would be little need to be more energy efficient (at least from a climate perspective). But in reality if we want to hit reasonable climate targets, *we have to reduce energy use.*"[35]

For Roberts, the only way of doing that is to decrease energy intensity, since he is under the impression that "virtually no one, ever, anywhere, talks openly about slowing economic growth as a means of mitigating climate change."[36] Other advocates of "matching exercises" as an approach to energy alternatives are not so squeamish about advocating degrowth or a "steady state" economy as a way of squaring energy use with earthly limits. Former World Bank economist Herman Daly, for instance, declares that:

> " . . . the closer the economy approaches the scale of the whole Earth, the more it will have to conform to the physical behavior mode of the Earth. That behaviour mode is a steady state – a system that permits qualitative development but not aggregate quantitative growth."[37]

University of Surrey professor of sustainable development Tim Jackson, similarly, advocates "establishing the limits" and then "integrating" or "coding" them into "economic functioning" and "social functioning" through "ecological macroeconomics". This "coding" process is supposed to result in an economic system free from the "perpetual expansion of debt-driven materialistic consumption" and the unending effort to improve the productivity of labour and maximize profit.[38]

Whether they favour growth or not, however, analysts who engage in "matching exercises" as an approach to energy alternatives seldom hold a brief for any particular demand figure. Their point is merely that if a certain level of demand is given, then supply must meet it. If the results are unpalatable, so be it: that is what signals that it is time to open a debate about the level of demand and overall resource use.

However such "matching exercises" are conceived, they fall in with the post-Cartesian habit of dividing reality up into sharply-separated, antagonistic, omnibus realms: an undiffentiated "society" on the one hand and, on the other, a stylized "nature" from which energy and other "resources" must be wrested. Running through much of all three tables, but especially Tables 1 and 2, is an overwhelming sense that resources are insufficient, that the need for them threatens the earth, and therefore that this inevitable, eternal tension, which cannot be transcended, must be "managed".

California-based energy researchers Mark Jacobson and Mark Delucchi, for example, go out of their way to stress that their proposal for renewables uses "only" one per cent more land than current energy installations occupy, as if care must always be taken to control inevitable human pressures on a wholly separate nonhuman reality. UK government adviser David MacKay, similarly, in sketching possible defences of nuclear power, emphasizes that the radioactive waste produced per capita every year by Britain's ten nuclear power stations amounts to "only" the volume of "one wine bottle".[39] For Tim Jackson, too, despite his strong critique of consumerism, there remains an underlying antagonism that can be addressed only by ecological investment, labour-intensive service industries, and the imposition of technical controls respecting ecological limits (rather than, say, democratic movements tackling the dominance of capital accumulation).[40]

The assumption throughout – and it is one that unites most environmentalists, neoliberal economists, politicians and resource managers – is

Many proposals take the form of simplistic exercises that try to match energy demand with renewable supply.

that energy is an abstract, inanimate fluid that, given human thirst for it, will always be subject to shortages or scarcity.[41] The challenge is always to "manage" that economic scarcity in a way that can preserve both "economy" and "environment". Narrowed down to an issue of "machine choice" – with carbon emissions often the variable emphasized most – energy policy usually becomes a matter of pretending to calculate or control "energy needs" over a specified time horizon, on a model inherited from the fossil fuel era; assessing the potential chemical output from different energy sources; weighing potential emissions against the need to meet targets for reducing greenhouse gases; projecting efficiency savings; allocating price tags to the different options, and then setting about assessing what mix of wind, solar, tidal, nuclear, geothermal, coal, oil and gas will "keep the lights on".

Within this framework, devotees of different types of machine network can then happily pick apart the numbers, manipulate and challenge the claims of their rivals ("windpower kills more people than nuclear"),[42] highlight dubious or downright misleading assumptions ("coal can be made carbon-neutral through carbon capture and storage",[43] "nuclear waste can be safely stored over millennia") and weave narratives that jockey their own preferred technological mix into pole position. But for all the clamour of the debate, the conclusions reached are remarkably similar: all must change, yet the underlying conditions of accumulation and scarcity can never change.

A Different Starting Point

This industrial ideology – or, rather, way of life – and the "matching exercises" associated with it contrast vividly with the style of reasoning evident in other proposals that are less structured by the imperatives of the corporate or government planning office, the laboratory, the statistical table, the economist's computer or the bureaucratic chain of command. For example, instead of assuming a generalized demand emanating from an abstract "society", initiatives such as those described by Clinica Ambiental in Ecuador, or the activists from Thailand's Prachuab Khiri Khan province, or the veteran wind developers of Denmark, or the Pgakenyaw people of Huay Hin Lad village in Northern Thailand (all in Table 3) start from a perspective sensitive to the differences in how different communities and classes treat energy, and strive to find ways of giving the distinctiveness of local livelihood priorities its due. Inevitably, that entails a type of planning that does not isolate energy as a separate subject matter, but views it as part of an evolving, locally-specific whole that also encompasses local politics, agriculture, health, family relations, human rights and so forth. From this perspective, energy alternatives are formulated by resisting pressures to address questions about kilojoules, biofuels and fuel cells in isolation, as a separate subject matter. Here, the starting point lies largely outside the domain of energy experts.

The more closely such approaches are examined, the less they seem to be "about" energy as a neatly-marked-off topic, and the more they seem to be addressing more complicated questions of what communities can

and want to be, given their unique histories. They are far from indifferent to technical issues – for example, how to learn about, develop, experiment with, install and pay for wind technology – but tend to understand the development of technology as entwined from the outset with issues of local democracy, local concerns, exploitation, and, often, local resistance to the energy projects that the state consistently seeks to justify on economic grounds. Here, "energy" as an industrial abstraction turns a limited number of intellectual gears. The oil extraction-affected communities behind the Ecuadorean initiative described by Clinica Ambiental (Table 3), for example, insist on addressing a mass of pressing questions as a coherent assemblage: "How can an integrated agriculture be promoted that avoids petroleum? What to do about violence within the family? How can toxics and plastics be eliminated from the community? How to deal with the question of education? How can energy alternatives help break community dependence on markets? How can personal energies be taken care of?" Like many Transition Town communities (also Table 3) in the UK and elsewhere, and in marked contrast to theorists from the World Wide Fund for Nature (WWF), the International Energy Authority (IEA) or the Rocky Mountain Institute (RMI) (Tables 1 and 2), they are wary of the idea of handing the major responsibility for the question of community energy futures over to the state or the private sector. Nor do they have any particular affinity for the abstract concepts – such as "supply", "efficiency" and "development" – associated with both.

More complex, better-grounded initiatives do not separate "energy" from other issues.

Like their Ecuadorean counterparts, thinkers about energy alternatives in Thailand's Prachuab Khiri Khan province ground their work in years of struggle against large-scale official energy projects – in the Prachuab case, a decade of successful resistance to two proposed coal-fired power plants of hundred-million-dollar scale. The Prachuab thinkers, too, are unconstrained by the need to find substitute centralized energy supplies or to separate "energy issues" from others. Faced with challenges from energy experts, they deliberately change the subject to the issue of how to maintain the successful farming, fishing and tourism livelihoods of local residents and to defend a just distribution of wealth. At the same time, they dissect the abstract economic concept of energy demand itself by exposing, with facts and figures, where the energy supplies planned for their region would actually go under current seaboard development plans (steel, petrochemicals and so on) and what the damage would be to local commons and distribution of goods.

None of this is to imply a fixed, eternal opposition between ordinary rural dwellers on the one hand and, on the other, experts accustomed to manipulating "Big-E Energy" – abstract, interconvertible, accumulable, scarce. Prachuab residents, for example, are accustomed to working with Bangkok-based groups – such as Palang Thai – skilled at critiquing the national electricity authority's consistent historical inflation of the "need" for Big-E Energy, (Table 2). Villagers from other parts of Thailand, meanwhile, have found other ways of integrating energy expertise, as conventionally conceived, with their own.

The process, however, is far from simple. One rural activist based in Surin province in the country's northeast described what happened after an alternative energy and appropriate technology NGO approached a local community:

Big-E "Energy" and Little-e "energies"

"Indian society was full of notions of energy. The first thing one had to do was to discipline all of these different varieties of energy into one term: the calorie. The words 'calorie' and 'watt' did more to create the Indian state than you can think of. It is this attempt to create a bounded notion of energy that made the state a disciplinary event. The scientist became the chief discipliner." [44]

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The abstract concept of "energy" that states and scientists use today – call it Energy with a capital "E" – has largely been a creation of fossil-fuelled industrial capitalism.[45] Coexisting with this abstract Energy are much older, multiple, vernacular, mutually-incommensurable "energies" associated with various subsistence purposes, together with indigenous conceptions of energy flows that bear little resemblance to the kilojoule-quantified interchanges of Energy.

Lower-case "energies" have never gone under a single name. Only fairly recently has it become possible to see charcoal fires, bullocks drawing ploughs and microwave cooking as instances of the same characterless, quantifiable "Energy consumption".

Lower case "energies" remain entangled with particular times – seasons, the daily cycle of light, the months it takes to grow crops or the years it takes to grow trees – and particular places – rivers where mills can be built, forests from which wood can be cut, latitudes where trade winds blow. Nor can they be transported in as large quantities or over as long distances as coal and oil.

Fossil fuels, however, allow industrial societies to abstract from time and place. With the tapping of millions of years of "fossilized sunshine", seasonal rhythms can be disregarded: fossil fuels burn up the equivalent of 400 years of plant growth annually, while fossil-fuel installations use 400 times less land than would be required for their equivalent in biomass to grow.[46]

Big-E Energy can be accumulated and deployed in unprecedented quantities anywhere regardless of the particularities of the local environment, allowing for the concentration of workers and, through mechanisation, expanding the surplus that can be extracted from them. Rural lands are meanwhile partly transformed into a manufactory of cheap food for labourers, their productivity in part underwritten by the same fossil fuels that transfer fire from the open fields into the combustion chamber.

Throughout this process, energy has become abstract: coal-fired steam engines, followed by internal combustion engines, have helped make heat and mechanical energy equivalent on a practical, mass scale. Electricity takes the process one step further, visibly transforming the energy embedded in fossil fuels into heat into mechanical energy into electromagnetic energy, which can be distributed widely only to be translated back into heat or mechanical energy.

The invention of a plastic Energy that can be enlisted without customary types of regard for time, place or context, moreover, has greatly encouraged the belief in the possibility of infinite economic growth.

> "The Association spoke to us of 'community energy'. But what was the difference between that and the general community planning that we were doing anyway? . . . That's what we felt then . . . At that time, people did not feel that energy was an important issue. We do not separate energy from our own life. It is in our life. We link it with the issue of food. Our resources, our self-sufficiency in food . . . other things . . . When we talked about energy, what did we think of? Immediately, we thought of electricity only. But we had no capacity to [generate electricity] . . . we don't have an oil well in the community, we get it from outside . . . It's difficult to get involved in generating electricity; it comes to our houses already; what else do we need to do? We hardly use any, not like the people in the cities, not like industrial estates. We hardly use any! So we wondered."[47]

Even as villagers slowly became more comfortable with a Big-E Energy concept that combines electricity with heat, motion, light and so forth in a single abstraction, they insisted on assimilating expert ways of speaking about energy into their own thinking. At the beginning, "we wanted to get involved and to learn and so we joined the process. To see how much CO_2 was emitted. They made a study of the whole province."

But when some of the villagers subsequently started using the plentiful local livestock manure for biogas, it was not carbon dioxide savings that most attracted them, but rather the independence and feeling of pride that the technology gave them. For the same reason, they found themselves untroubled by the fact that "it is slow and they don't get as much as they could from LPG canisters".

Similarly, when other new practices, such as planting the oil crop jatropha as a substitute for fossil fuel, ran into problems, it was not just a matter of energy cost calculations:

> "The down side of jatropha is to do with the management of it. The seeds do not mature at the same time, which makes harvesting difficult. Another problem is related to the machine to crush the seeds to get oil. Sometimes in the community, we have limitations. We don't have the funds to buy the machinery, and the tools. The crushing tools require a lot of physical pressure; it is not easy to get enough oil. People became less and less interested. We do have one machine which we share around, but it's not enough for the various villages. The technology must respond to what the community needs."[48]

Most significantly of all, perhaps, community members saw their *adoption* of biogas and improved stove technologies as of a piece with their *opposition* to a commercial biomass generating plant which pollutes local communities and stakes a new kind of claim to local biomass. "We're just supposed to offer up everything we have to them?" asked one local activist:

> "It's more and more likely that wood will be used. They just think of the forests as soaking up CO_2. We think of planting forests to soak up carbon too, but it's all about improving the air. But others think of planting forests, to soak up carbon, to sell it! Different ideas. We have to fight this type of thinking. They don't stop thinking of selling things."[49]

Villagers also criticized a three-megawatt solar energy project on offer:

> "It sounds clean, but if we try to look closely it is not really clean . . . even if it is 'alternative', it still destroys. Maybe it's better than fossil fuels from the point of view of emissions or pollution, but *we have to know when is enough.*"[50]

To a European energy expert, household biogas and improved charcoal stoves might seem to be "the same thing" as commercial biomass and solar generating plants. They all look like "alternative energy". From the more layered point of view of the Surin villagers, however, the two innovations could not be more opposed to each other.

Such approaches find a distant echo in many European Transition Town initiatives (Table 3), participation in which tends to develop not merely out of concern over "peak oil" or climate change, but also because the initiatives promise the possibility of a "fairer world", a "space to build your own projects", and "fun",[51] in the process gradually opening up for questioning the scarcity postulate of proposals premised on matching supply and demand. Such questioning also lurks in the background of many proposals circulating in Europe about "how to live a low-carbon

Commons vs. Resources

In commons regimes, the right to survive overshadows exclusive individual rights to possess, exchange, and accumulate. Communal use puts land, water and work in dialogue with local needs rather than transforming them for trade and accumulation.

Faced with the social divisions characteristic of commodification, the commons impulse is to tap wages for subsistence, defend local pricing, pressure the state into providing spaces for the vulnerable, fragment money itself into different types earmarked for different uses, even, where necessary, transform individually-titled land into nonsaleable plots governed by the community.

Commons patterns often deny certain rights to outsiders, particularly commercial interests, and in the past have instituted separate spheres for men and women, usually under patriarchal control, in household and community.

Resource regimes, by contrast, allow subsistence rights only to private property owners, not the groups that conventional economics calls "unemployed".

Faced with common land, the resource imperative is to seek subsidies to fence off, mobilize and develop it for production, consumption and exchange, disregarding local adaptations if necessary. Societies and human bodies are shaped around centrally-organized norms. Work is a commodity activating capital accumulation and competition.

Rather than earning enough for their needs, individuals learn to have needs they can satisfy with the money they must earn. Women tend to suffer unequal wages or confinement to a domestic domain appended to capital accumulation, which is often narrower than that associated with commons patterns.

The whole process creates and intensifies a type of scarcity which comes to be regarded as an eternal category rather than something peculiar to an era of capital accumulation.

Market expansion makes possible both new forms of oppression and ethnic division and new "arm's-length" notions of responsibility that encourage humanitarianism and notions of universal human rights.

Both commons and resource patterns are simultaneously physical, social, conceptual. Although in continual conflict with each other, both can be found sharing the same landscapes, the same communities and the same brains.

Both are constantly being ripped apart and patched up into new forms; each influences and encroaches on the other. They are like two different systems of roads crisscrossing a landscape, one consisting of local byways, the other of imperial, state, or long-distance trading highways.

Both have a long history, but while commons patterns have often existed without resource patterns, resource patterns have never been able to survive without commons patterns. Modern politics is fought on the field this tension defines.

individual lifestyle", in which an initial emphasis on measurement and management of personal "carbon" responsibility tends to merge, in the end, into concern and action about broader issues of community life.

The conflict between "matching exercise" approaches to energy alternatives and more complex orientations that take into account the historical dynamics of accumulation and the undetachability of energy issues from the rest of social life ultimately intersect with a broader conflict of longer historical pedigree: the tension between capital and commons.[52] Whether or not they treat demand, consumption or growth as variables on which "limits" can be externally imposed, attempts to formulate energy alternatives on the basis of matching energy supply with energy use tend to militate against forms of social organization that give pride of place to subsistence for all, and that work to deconstruct the opposition between human and natural realms enshrined in the contemporary epithet "natural resource management". Making connections with struggles over commons is especially important strategically in that it helps signal that the tensions among various visions of energy alternatives visible in Tables 1-3 extend far beyond the confines of the expert energy debate alone.

Energy Efficiency

One of the most important tensions between abstract, simplistic views of the "energy alternatives" issue and more encompassing or nuanced conceptions revolves around the notion of energy efficiency – which turns out on close examination to be a far more controversial concept than commonly perceived in industrial societies.

Many energy alternatives proposals see energy efficiency as at least a short-term way of reducing demand, making supplies go further, or rendering unnecessary the expansion of energy-generating capacity. Sometimes the assumption is as simple as that energy efficiency reduces energy demand in a one-to-one manner: that, for example, a 30 per cent gain in efficiency leads to a 30 per cent reduction in total energy use – an assumption that the International Energy Agency (Table 1), for one, appears to hold. More often, it is conceded that energy-use reductions may not keep exact pace with efficiency improvements, or that there is some unpredictability in the relationship between efficiency improvements and reduced consumption. But the overall picture is that, on the whole, efficiency improvements are a contribution toward bringing society's energy use in line with energy supplies or with global ecological "limits". More efficient boilers and lights, better insulation, improved electronic control systems and so on, the argument goes, necessarily spell less use of coal, oil and gas, bringing one step closer the goal of a carbon-free, minimal-emissions society.

As US economist John Polimeni points out, this linear vision is often linked with economic orthodoxy regarding the effectiveness of price in bringing about change:

> "Standard economic theory finds that energy prices will increase as the supply of natural resources used to produce energy, such as oil and natural gas, decreases. This supply-demand relationship creates a price signal that will encourage investment into the research and development of new energy-efficient technologies that will reduce energy consumption. In the long run, these technologies will lead to lower energy intensities for households and firms. The end result will be an improvement in environmental quality, through a reduction in the consumption of natural resources, with a minimal effect on the economy."[53]

The Rocky Mountain Institute (Table 2) cites the impressive fact that the US today uses only half the total energy it would have used at its 1975 energy intensity. China defends its energy policy in climate negotiations by noting that its energy intensity, too, is declining. The implication is that increased efficiencies have put both countries on a linear path of "dematerialization" or "decoupling" from excessive "material throughput" – a path that, other things being equal, needs only to be followed to its end for the problem of energy to be largely solved.

Small wonder that the International Energy Agency feels no qualms about stating baldly that "[s]carce public resources should be focused on leveraging the maximum uptake of energy efficiency".[54] Counting on efficiency for roughly half the emissions reductions needed in its climate stabilization scenario, the IEA notes with satisfaction that promoting energy efficiency would allow energy companies a few more years to build fossil fuel-fired plants and facilities before the possibility

of limiting global warming to 2 degrees Celsius vanishes. To many environmental activists as well, putting energy efficiency at the centre of alternative energy programmes looks to be a no-brainer – a seemingly unobjectionable technical measure that can play a part in any plan. "It's really that simple," enthuses David Goldstein of the National Resources Defense Council, a Washington NGO.[55]

But other thinkers about energy alternatives – British author George Monbiot, for example – adopt a warier, more nuanced attitude toward efficiency-based policies, often basing their doubts on evidence from economic history.[56] One oft-cited complication relates to the scale of analysis. Many goods and processes that appear energy-efficient over one unit of space or time are inefficient over another. For example, a car may be designed to be maximally energy-efficient at covering one kilometre in one minute, yet be astoundingly inefficient at going the same kilometre in comparison with vehicles designed to travel at slower speeds.

Similarly, once it is in operation, a blender may produce juice, or a pulp and paper mill a sheet of paper, efficiently relative to the energy input provided. But each such technology presupposes a far-reaching infrastructure whose historical construction may have a considerable energy budget that is left out of efficiency calculations. How much energy was lost, for example, in re-engineering over many years the landscapes that support the power plants and electricity lines that make the blender work, or the fast-growing tree plantations that feed the pulp mill? Similarly, hydrogen-powered cars may work efficiently per unit of fuel in getting passengers from point A to point B at a given (usually high) speed, but they also require additional expenditures of energy to break down water or natural gas into hydrogen and to build an infrastructure for delivering it to each vehicle. Agrofuels, too, however effective they may be at powering motor vehicles, are generally extremely inefficient in energy terms when their whole life-cycle is considered, often requiring more energy to produce than they provide.[57]

To many observers, boosting energy efficiency seems an uncontroversial part of any energy transition.

By the same token, today's wind and solar energy devices are constantly improving their individual energy output/input ratios, but the economies of scale that are needed to make them cheap enough to be used extensively require new global infrastructures that exact a high price in both thermodynamic work and the degradation of human and nonhuman beings. For example, modern windmill and solar technologies require that systems be set up to mine and transport large quantities of rare earths – largely from China – to factories producing the high-tech batteries and other components needed. One result is that police and lawyers have to be mobilized to help dispossess peasants or contaminated communities who may have adverse views on the proceedings, as well as cleanup equipment in order to try to fix the environmental mess. In a standard pattern, the profits that these economies of scale make possible are then used to underwrite the appropriation of ever greater amounts of energy and other resources from the periphery.[58] Again, a historically- and geographically-informed perspective tends to cast doubt on the very idea of treating energy efficiency as as an effective, stand-alone component of a programme of alternatives in abstraction from the complex context of industrial society in which energy savings are sought.

No End to Conflict

Brian Rutledge is the Executive Director of the Wyoming branch of the Audubon Society, a US environmental group. Recently the western state has been the focus of a "wind rush" that has seen windfarm promoters working overtime to capture subsidies and other "supplemental funds that are based around getting the shovel in the ground".

Rutledge is worried by the summary dismissal of concerns over the environmental impacts on windfarms on birds, bats (the sudden drop in air pressure close to the turbine blades can cause severe lung damage to bats) and the region's sagebrush ecosystem. Rutledge complains:

> "We tried to have a negotiated discussion with them and were basically told, 'We're saving the world, we don't need your permission; we're going to do what we want'. And it was really astounding to have people doing this kind of capitalist charge in the name of the environment."[59]

Rutledge's experience is similar to that of many communities in the global South affected by big hydroelectric dams, who have learned that proponents of "alternative" energies often do not want to discuss the social and environmental impacts of their supposedly "green" projects,

These impacts are often considerable. Moving away toward carbon-free forms of energy will never be just a question of plugging "greener" energy sources into the existing electrical power system. "Greening" an ever-growing economy would require the replacement of much of the world's existing energy generating and distribution system, the seizure of vast land areas, the retrofitting of old buildings on a historically-unprecedented scale and the redesign of whole cities. Conflicts over landscapes and livelihoods are inevitable.

The impact of solar and wind parks is often downplayed. The promoters of Desertec, a plan to cover 2,500 km² of North Africa with solar panels and to lay 3,500 km of transmission lines in order to distribute the power throughout Europe, the Middle East and North Africa, argue that the total area affected would be no bigger than the reservoir of the Aswan Dam in Egypt, while producing 30 times the electricity of the dam.[60]

Others argue that the new electricity generating plants will be sited in areas that are "unwanted", such as deserts, or, as in the case of a planned wind farm corridor in the Indian states of Karnataka, Andra Pradesh and Tamil Nadu, on "wastelands".

Such claims are generally either misleading or false. Outside of Antartica, there is nowhere on the planet (even desert) that is not "home" to someone. Land dismissed as "wasteland" is often land on which poorer people, notably the landless, are most dependent for their livelihoods. Nor can the damage caused by new "green energy" projects be reduced to the physical surface that they occupy. Impacts also occur "upstream" – from the mining and other activities necessary to supply machine components – and "downstream" – from the uses to which the energy produced is put.

The new green machines can contribute to conflict in other ways, too. For example, electromagnetic fields generated by smart grids may adversely affect birds, butterflies, fish, marine mammals and bees, whose migrations are guided by the earth's natural electromagnetic background. Civil liberty groups are meanwhile questioning the use of smart grids for surveillance of citizens.

In Mexico, local residents from San Dionisio del Mar, Oaxaca, are protesting against the construction of a 396-megawatt wind farm that will be used to power Coca-Cola and beer-bottling factories. Opposition leaders have reportedly received death threats and the community claims that it was not told of the project's potential environmental impacts.[61]

In India, Suzlon, which has grown through private equity investment to become the country's largest wind energy company and the fifth largest in the world, has been accused of "cheating tribal people off their land in order to set up wind farms" and "harvest[ing] profits from green energy and carbon offsets"[62] – a charge the company denies.

Local opposition has also dogged Bhilwara Energy's plans[63] to develop several medium-to-large scale hydropower assets,[64] while 3,000 farmers recently protested against what they say is the illegal expropriation of their land for a dam proposed by Adani Pench Power Limited.[65]

The toxic pollution caused by mining the rare earth elements that are essential components of the electric motors used in windmills is also causing increasing conflict. In northern China, the mining of rare earths has polluted a five-mile-wide lake used to dump the wastes left over after the rare earth has been doused in chemicals to extract its marketable elements. Farmland has been poisoned, killing animals, while local residents suffer from a range of pollution-induced ailments, from skin diseases to breathing problems and cancer.[66] Such devastation is likely to spread further once the most readily accessible deposits have been exhausted.

One useful way of distinguishing among different proposals' attitudes toward efficiency is to examine their stances regarding "the Jevons Paradox", a shorthand for a loosely-associated set of theses associated with the 19th-century British economist William Stanley Jevons.

The Jevons Paradox

Jevons is famous for arguing that "[i]t is a confusion of ideas to suppose that the economical use of fuel is equivalent to diminished consumption. The very contrary is the truth."[67] Today, the Jevons Paradox names what is in fact a variety of different hypotheses active in a variety of different debates.

One relatively uninteresting debate is about the extent to which efficiency gains in a particular process will encourage individual consumers to use more of the process, or use the money they save to increase their consumption of energy in some other way. Homeowners who make their furnaces more energy-efficient, for example, may decide they can now afford to keep their houses heated to 19 rather than 15 degrees Celsius, decreasing or even wiping out any energy savings. Or they may use the money they save on heating to buy more (energy-efficient) appliances, with the result that their electricity meters fail to show as much of a reduction in energy use as might be expected.

Many orthodox economists investigating energy alternatives indulge in arcane attempts to quantify such effects for various goods at the household or national levels. Depending on assumptions,[68] their estimates of the degree to which efficiency improvements are nullified by subsequent growth in energy use vary from 5 per cent to more than 200 per cent.[69]

Such results by themselves are enough to challenge the idea that a linear relationship between energy efficiency and reduced energy use can be assumed. But other thinkers working on energy alternatives argue that these calculational exercises, diverting as they are, do not really get at what is important about the Jevons Paradox, which concerns the way industrial societies evolve as a whole. For them, the important question connected with the paradox is not, say, whether individual US suburban households will take the savings that energy-efficient toasters provide them and squander them on toasting 100 slices of bread every morning, or on buying second toasters for their bedrooms. No one believes that. The real issue at stake, they insist, is whether and how efficiency increases in one or more sectors or technologies augment energy use across a whole industrial society over the long term.[70] Here the focus shifts to the more complex question of energy efficiency's role in "changing the matrices of the economy, such that the overall effect is to increase scale and tempo of the system as a whole".[71]

Historically, energy efficiency has been linked to overall* increases *in energy use.

In industrial societies, efficiency makes more funds available not only for consumption but also for investment. This is so whether the cash comes from lowering energy input per unit of comfort or commodity output or from deploying the same energy input for more comfort or a larger commodity output and thus more profit. When multinational firms like Dow Chemical, United Technologies and 3M improve their energy

efficiency, for example, they save billions of dollars that they can use to build out their businesses.[72] And state-sponsored innovation can be as effective as private innovation in freeing up capital for investment. Increased investment, in turn, tends to entail more overall extraction, manufacture, consumption, buying and selling, capital formation, energy expenditure and pollution. Within an industrial society, in other words, efficiency gains do not leave everything else as it is, but tend to be used to expand the overall scale of production and accelerate turnover. As Galo Veintimilla, a founder of the Ecuadorian environmental NGO Acción Ecológica, who works on energy alternatives in rural areas, notes, the use of lighter airplane materials has not meant fewer or slower planes, but more and faster ones, which has resulted in a concentration of energy resources in fewer hands, "which means concentration of power".[73] Cell phones and the internet, similarly, have not meant fewer roads or fewer cars. The speed at which money is transferred, or at which airplane users travel, may have increased, but for many ordinary people, transport institutions and technologies eat up more and more time and effort.[74]

Productivity and Efficiency

Industrial firms have always tried to improve the productivity of their workers, whether through mechanization or social engineering. In the business world, to try to get more output from a given input is just common sense.

On the surface, it might seem that every increment of increased production that results from hooking workers up to machines, or making humans themselves behave more like machines (through, for example, time-and-motion studies), would entail less need for human labour. And that might be true if every firm's goal were a fixed level of production.

But in fact, productivity increases are usually used to expand the volume, speed and types of production and consumption in order to make more money. In the context of continuing capital accumulation, that often means new and different jobs as well. As British economist William Stanley Jevons put it nearly 150 years ago:

> "The economy of labour effected by the introduction of new machinery throws labourers out of employment for the moment. But such is the increased demand for the cheapened products, that eventually the sphere of employment is greatly widened. Often the very labourers whose labour is saved find their more efficient labour more demanded than before."[75]

For example, after Eli Whitney invented the cotton gin, fewer workers were needed to produce a given mass of separated cotton fibres. But more workers were eventually needed to load the increased volume of ginned cotton onto barges, transport it to market, respond to the increased demand for cotton goods following on from their lowered price, and so forth.

Far from being an exotic curiosity, the Jevons Paradox is thus what lends force to the threat that presidents and prime ministers of industrialized countries have (usually successfully)[76] used against their working citizens for more than a century: never mind the fact that you may be laid off at any time; support endless capital accumulation ("economic growth") or you will die.

In industrialized societies, in short, a 50 per cent improvement in labour productivity has never resulted in a permanent 50 per cent rise in unemployment. If that were true, few people would have a job today. Nor has it ever signalled the advent of a leisure society where people need work only 20, then 10, then only two hours a week. US labourers, for instance, are far more productive than they were a century ago. But they are not working less; they are only making more stuff – and using more energy.

The same lesson applies to the energy efficiency debate. In a society driven by accumulation, there is no reason to expect that a 50 per cent improvement in energy efficiency will result in a 50 per cent drop in energy use – or 50 per cent less demand for fossil fuels.

Legislators' rhetoric, television commercials and propaganda for NGO-corporate partnerships have tried to convince the public that when business understands how profitable efficiency measures can be, it will at long last go green. But just as higher labour productivity does not in the long term mean less work, so, too, gains in energy efficiency do not mean less long-term energy use.

Increases in efficiency, in addition, do not just make it possible to do "more of the same" in the short term – for example, fly more in order to take advantage of the lower costs associated with improved aircraft passenger-mile/fuel ratios. They also "expand the option space of consumption",[77] as energy savings drive the evolution of diversified products and services with wider functions and consumer appeal. Thus improving the energy efficiency of internal combustion engines, instead of leading to better miles-per-gallon-per-passenger figures, may lead to nothing more than a different kind of car: heavier, more powerful, and loaded with more features such as air conditioning. Similarly, cheap flights may make possible explosive growth in the international tourism industry, which then feeds back into more demand for aviation. Policy experts Ted Nordhaus, Michael Schellenberger and Jesse Jenkins of the US-based Breakthrough Institute find that efficiency improvements in lighting, engines, motors, computing, and other general-use technologies are particularly prone to unlocking "unforeseen new energy-using applications, products, or even whole new industries."[78]

Efficiency improvements, in other words, change the things that efficiency is *of*. Instead of measuring how many miles per gallon they can get with a 540-kilogramme Model T made in 1913, technicians now measure the gas mileage of, say, a 2,700-kilogramme sports utility vehicle with power steering and three-row seating (the Model T usually wins).[79] Such altered objects, in turn, change their infrastructural environments to accord better with their needs. They also demand increased inputs of raw materials and energy for their manufacture. And they tend to attract more customers, whose own "energy", as Veintomilla points out, is channeled through advertising into desires to capture and inject still more mineral-derived energy "like a shot". All these transformations mean more energy use.

Because the way efficiency is calculated also changes, any attempt to evaluate an energy policy over time using a fixed formula for quantifying efficiency gains eventually starts to look simplistic. As prominent ecological economists Pietro Giampietro and Kozo Mayumi argue, it is impossible for researchers to "predict the effect of an increase in efficiency" using the conception of efficiency they began with.[80] Efficiency imperatives tend to expand the number of commodities needing separate efficiency requirements, which in turn have the potential to encourage still more energy-using product lines, and so on, in a way that neither economists nor lawmakers can foresee. A century ago, no mere energy efficiency legislation could have curbed – though it might have inadvertently encouraged – the emergence of the automobile economy and the road infrastructure it demands. Today's efficiency regulations – packed with provisions requiring a certain mileage per litre of fuel, based on accepting as a norm the existence of tens of millions of cars of a type capable of speeds of 100 kilometres per hour as well as vast systems of superhighways – are, ironically, likely only to undermine efforts to predict and monitor energy efficiency improvements over the long term.[81]

Efficiency improvements tend to change the nature of the products to which they are applied.

By the same token, current formulations of efficiency make little sense when applied to a distant past. While roads can be viewed retrospectively as having made possible more efficient transport at the speeds and capacities made possible by the technologies that come to use them

(carts or lorries too wide for a path, for example), the gain to road users cannot be measured – as the early political economist Jean-Baptiste Say observed as early as 1803 – because with no road "the transport would never take place at all".[82] Freezing steam engine development at an 18th century level, or car development at a Model T level, would have resulted in a world with far less energy use. The idea that such a choice would have been well-advised might seem incomprehensible to most people today, but it would be difficult to criticize it as having been "inefficient".

Efficiency and Growth

Jevons himself summed up the predicament pointedly in 1866 when he wrote that efficiency had always been key to industrial accumulation:

> "the whole of our present vast industrial system, and its consequent consumption of coal, has chiefly arisen from successive measures of economy [i.e., efficiency] . . . it is the very economy of [coal's] use which leads to its extensive consumption."[83]

For example, spectacular improvements in the energy efficiency of lighting during the 18th, 19th and 20th centuries not only helped open a space in the UK for an increase in the consumption of artificial light of five orders of magnitude.[84] They also contributed to a more general increase in energy intensity and energy consumption across the society. Cheaper light in greater quantities boosted labour productivity by lengthening the working day, enabling large machines to repay investment by being run around the clock. New frontiers were opened in night transportation, advertising, power infrastructure and home electrification.[85]

Efficiency improvements were equally deeply entwined in the transition from sail to steam navigation – and hence in the emergence of globalized economies of scale and expertise for the extraction of coal and iron and the engineering of thousands of energy-gobbling industrial machines. For more than a century following their introduction into England around 1700, steam engines could not compete on land with water or wind power. In the world of shipping, they were not even a contender. Even in the 1830s, steam engine developers were still struggling to make their machines energy-efficient enough to be useful outside the fuel-rich vicinity of coal mines, where they were used to pump water out of underground seams.[86] Yet, as anthropologist Stephen Bunker recounts:

> "a series of innovations in motor design . . . reduced coal consumption per horsepower-hour from the eight to ten pounds of the 1830s single-cylinder motors to the two pounds of the 1860s compound engines. The even more efficient high-pressure triple expansion engine of the 1880s finally doomed the sailing ships. The boom in steamboat construction significantly stimulated machine tooling and engine-building technologies, as well as stimulating the sophistication of specialized production units and their reincorporation into a large, complex production process."[87]

Steamboats subsequently not only multiplied seafaring trade, but also helped open up continental interiors to increased extraction – including extraction of coal and other energy commodities.

From Containerships to Wikipedia

Such patterns repeat themselves throughout modern economic history. Between the 1950s and the 1980s, for example, the replacement of traditional cargo vessels with containerships was also deeply entangled with the imperative to economize – to reduce corporate dependence on waterfront and marine labour; to destroy, redesign and rebuild infrastructure to eliminate logistical bottlenecks interfering with rapid turnover; and also to be able to transport more cargo per barrel of oil. Yet increased efficiency in shipping, by expanding world trade, globalising consumption, and pushing the most far-flung countries into competition with each other to be low-cost suppliers of raw materials, resulted in vastly greater world energy use. By the 1990s, giant oil-fired containerships were plying the oceans bearing unprecedented quantities of cheap wage goods produced with coal-fired electricity in China to Wal-Marts in North America and *hypermarchés* in France. Business journalist Marc Levinson outlines some of the dynamics at work as the containership revolution came to maturity:

> "Bigger ships lowered the cost of carrying each container. Bigger ports with bigger cranes lowered the cost of handling each ship. Bigger containers – the 20-foot box, shippers' favorite in the early 1970s, was yielding to the 40-footer – cut down on crane movements and reduced the time needed to turn a vessel around in port, making more efficient use of capital. A virtuous circle had developed: lower costs per container permitted lower rates, which drew more freight, which supported yet more investments in order to lower unit costs even more . . . Total cargo capacity aboard containerships, 1.9 million tons in 1970, reached 10 million in 1980 . . . Containers turned ports into mere 'load centers,' places through which large amounts of cargo flowed with hardly a break."[88]

For many energy alternatives thinkers, of course, what Levinson describes as a "virtuous circle" looks pretty vicious. In the most fundamental areas of industrial life, they argue, greater efficiency has not decreased but rather increased the overall rate of consumption of energy.

Circumstantial statistical evidence is often cited to support the claim. Global energy intensity is one-third lower than it was in 1970, yet the world uses twice as much energy and emits 80 per cent more carbon dioxide from fossil fuels.[89] In the US, energy use per unit of GDP halved between 1975 and 2010, yet energy consumption per capita remained flat and overall energy use increased by 40 per cent. Between 1980 and 2004, Europe also saw an increase in energy efficiency accompanied by growth in energy consumption, as did other regions of the world.[90] Energy efficiency, energy consumption per capita, and overall energy use also kept close pace with each other in Japan between 1970 and 1980.[91]

As economist Juliet Schor reports, moreover, "energy demand rose fastest in those sectors that have had the biggest efficiency gains – transport and residential energy use."[92] In aviation, fuel burned per seat-mile dropped 82 per cent between 1958 and 2010,[93] but the number of passengers rose from less than 62 million[94] to 1.6 billion in 2003, and then to 2.4 billion in 2010. Between 1975 and 2000, aviation fuel consumption per passenger mile dropped more than 30 per cent in the US, yet absolute fuel consumption more than doubled.[95] Between 1975 and 2010,

refrigerator efficiency improved by 10 per cent, but the number of refrigerators in use rose by 20 per cent.[96] Even certain kinds of simple economic modelling predict that efficiency measures will eventually cause more energy use economy-wide than they prevent.[97] The picture is one of an endless arms race, with every efficiency increase spurring a rise in consumption, which – especially nowadays, with pressures from environmentalists – then hastens efforts to increase efficiency, which then boosts consumption again, and so on.

Devotees of energy efficiency often take justified exception to such inferences. They point out that evidence for a causal link between improvements in efficiency engineered into any particular set of technologies and overall increases in consumption and production is circumstantial. After all, perhaps without efficiency improvements, things might have turned out even worse: in the US, airline fuel use might have tripled rather than doubled in the last quarter of the 20th century, and so on.

Critics counter that defenders of efficiency cannot coherently quantify their claims, either. Economist Blake Alcott points out the obvious: while the energy use of a society is measured as an absolute number, efficiency is usually measured as a ratio of output to energy input, and "it is impossible to derive an absolute number from a ratio or change in a ratio".[98] Logically, maximizing output per unit of energy input or minimizing energy input per unit of output is consistent with either an absolute decrease or an absolute increase in a society's input and output. The more important phenomenon, on this view, is the unquantifiable pressure for absolute increase deriving from the imperative to accumulate. If the efficiency of lighting, steam power or internal combustion engines had not improved stupendously in the past, the scope for energy use by business could not be what it is today. To argue otherwise is to summon surrealistic visions of corporate headquarters using up thousands of candles daily, or bankrupting themselves by stuffing their offices with hundreds of clunky, expensive 1980-vintage IBM microcomputers, or devoting nearly the entire cargo decks of their containerships to storing coal for the engines.

Elephants may seem more "energy efficient" than mice, but that hardly means that they are "dematerialized" versions of mice.

Similarly, it is implausible to suggest that without past increases in automobile efficiency, there would be cars on the market today with top speeds of 200 kilometres per hour; or that without past improvements in computer processing efficiency, Wikipedia could today be scoring tens of millions of hits daily and occupying megawatts of server capacity; or that without improvements in air-conditioner efficiency and price, it would be possible for room cooling to account for 40 per cent of the energy use of Mumbai, or for US cities like Las Vegas, Phoenix, Houston, Austin and Atlanta to have experienced their explosive growth rates of recent decades.

Thus it is hardly surprising that while the US may generate much more GDP per kilowatt-hour than it did 35 years ago, its energy consumption per capita remains at more or less the same world-beating level, and the total energy that the country consumes has gone up by around half.[99] As economists Giampietro and Mayumi note, it makes about as much sense to claim that efficiency is helping to "dematerialize" the US, Chinese

or any other economy as it would be to say that, because elephants use six times less energy per kilogramme of weight than mice do, they are therefore "dematerialized" versions of mice.[100]

Anti-Efficiency: Coming out of the Closet

Energy thinkers and activists who are sensitive to economic history and the dynamics of capital and who recognize the importance of the Jevons Paradox have taken a wide variety of sometimes conflicting stances in response.

Some die-hard defenders of efficiency claim that the Jevons Paradox "does not harm the case for energy efficiency. In any way. At all. Even a little."[101] If there is an "arms race" between efficiency improvements and increased consumption, they insist, some day it can be made benign by ensuring that the rate of decline in energy intensity outruns the rate of economic growth. So what if "for every one step forward we take on efficiency, we take a half step (or a third of a step, or two-thirds of a step, or whatever) back" due to Jevons effects? All that means is that "we need two or three or four times more efficiency than we thought to hit the familiar energy-use reduction targets in most climate scenarios."[102] And presumably if the rich world's economies grow at three per cent per year until 2070, and the poorest nations catch up with them in energy use, the "only" thing that will be required is several hundred times more efficiency.[103] And so on. Some analysts, in addition, express the hope that perhaps the accumulation that efficiency feeds will bring about a modernization process that is low-carbon. Some, too, resurrect the now largely-discredited idea that perhaps as a society becomes richer and more energy-greedy as a partial result of efficiency measures, it will nevertheless also start to value the environment more than poorer societies do.[104]

Can the tendency of efficiency improvements to spur increased consumption be blocked?

For the Breakthrough Institute's Nordhaus, Schellenberger and Jenkins, who are "skeptical of the ability of below-cost energy efficiency to drive real and lasting reductions in total energy consumption, and thus the ability of efficiency measures to significantly contribute to climate and energy security objectives directly," the main moral is that emphasis should be on the energy-production side of a supply-demand matching exercise:

> "Relying on a linear, direct, and one-to-one relationship between below-cost energy efficiency improvements and carbon emission reductions, as is almost universally the case in contemporary policymaking, is very likely to lead nations and the world on a dangerous path. Efforts to reliably reduce greenhouse gas emissions or dependence on depleting fossil fuels . . . should therefore focus primarily on shifting the means of energy production (rather than end use), relying on zero-carbon and renewable energy sources to diversify and decarbonize the global energy supply system."[105]

Slightly more critical approaches to the Jevons predicament seek to change the social and economic context in which efficiency improvements are

Efficiency and Consumerism

It is fashionable among environmentalists – and convenient for elected officials – to blame excessive energy use on "consumerism". In Europe and North America in particular, moral blame is often attached to individual consumers for buying apples shipped from New Zealand or luxury cars equipped with retractable sun roofs and climate control. In this way, pressures for political change are deflected into campaigns for improved consumer "ethics".

Consumers are enjoined to "do their bit" by purchasing more less energy-intensive goods and more efficient services. Failures to get results are blamed on the public, "human nature", or inadequate moral education.

A more thoroughgoing approach would seek to understand the role energy efficiency itself has played in making energy-intensive commodities not only "normal", but also, often, the only commodities available. After all, it is only through efficiency improvements that apples have become pampered passengers on long-haul jet flights, or car engines platforms supporting heavy cargoes of automotive accessories.

Tracing the unbreakable connections among efficiency, increased production and increased consumption encourages a vision of political action that goes far beyond attempts to reform consumer morals.

achieved. One idea is to try to cut or attenuate some of the links among energy efficiency, accumulation and increases in energy use. For example, energy savings could be taxed to prevent them from being used for more consumption,[106] and the revenues used for a green transition that did not result in increases in economic productivity.[107] (Interestingly, this proposal flies in the face of currently fashionable policies making savings in greenhouse gas emissions into a saleable commodity, such as the EU Emissions Trading Scheme.)[108] Or above-cost energy efficiency measures could be supported in a way that prevented energy prices from going down. Or energy supplies could be capped, thereby bringing up short, at a certain point, the ability of efficiency improvements to expand the energy economy.[109] (This proposal, while on the one hand reinforcing incentives for business to make do with less, on the other makes efficiency less business-friendly in the long term insofar as it threatens the future expansion of the "option space of consumption".)[110]

Suspecting such approaches of being by themselves unfeasibly timid, scattershot and *ad hoc*, more holistic strategies for confronting the intricacies of the Jevons Paradox critique efficiency itself. On this view, efficiency is simply not a useful criterion for distinguishing transformational, long-term energy alternatives; other, more complex and realistic criteria – such as potential for helping to increase the space for the evolution of commons at the expense of capital – must be sought instead.

Despite following fairly naturally from a contemporary Jevons perspective, this strategy seldom dares speak its name in the industrialized world. Understandably, the mere sight of an "anti-efficiency" banner scandalizes the energy alternatives mainstream in Europe, North America and much of Asia. To an industrialized-society sensibility, an environmentalist anti-efficiency stance seems self-contradictory if not incomprehensible. What could it possibly mean? That profligate and careless use of energy is good? That we should give up the idea of reductions and encourage everybody to waste as much energy as possible? That activists should not campaign for improved grid connectors or home insulation as a way of reducing energy use and stopping the construction of more coal-fired power plants? To call efficiency into question sounds not only like a brief for gluttony, greed, sloth and other deadly sins, but also like an insult to Northern consumers' sincere efforts to make the best of things by switching to photovoltaic power or buying energy-efficient cars and

light bulbs. Equally disturbingly, it seems to block the road of inquiry: to infringe the rights of innovators to exercise their creativity freely to find new ways to make energy savings. That sounds repressive, almost Luddite. What could possibly justify squashing the quest for ingenious ways to produce and consume ever more economically?

Other observers, many from the South or from indigenous communities, are less perturbed by the spectre of anti-efficiency. For them, questioning a simplistic focus on energy efficiency is often part of the everyday work of preventing commons from being transformed into, say, "resources for the production of passenger miles,"[111] or raw material for new green technologies. As social critic Ivan Illich pointed out many years ago, a critique of efficiency is necessary in order to defend or recover crucial possibilities of freedom – for, example, the freedom of those who need or choose to remain afoot in the face of a high-speed transport economy that encroaches on their survival space.[112]

But such stances are likely only to inflame the frustration of European experts who, reasoning that efficiency is "better than nothing", observe that official funding would be better applied to energy efficiency research programmes than to their nuclear- and fossil fuel-promoting counterparts. It is not that the concept of anti-efficiency is merely taboo, or of a kind not to be mentioned in polite company. The problem is more radical: it breaks the categories by which the industrial universe is conceptually organized, so that anyone who adopts it risks being thought, in Illich's terms, "a fiend or impossibly vain".[113]

Efficiency vs. Good Housekeeping

Given the widespread difficulty in making sense of the concept of anti-efficiency, are there ways to take forward the global efficiency debate by cooling tempers, trying to locate where minds are failing to meet, and understanding why they are not meeting?

One way of lessening the shock value to many Europeans of the critique of energy efficiency might be to reflect on how even the most single-minded efficiency advocates are likely to be matter-of-factly anti-efficiency in many contexts, even if they may not at first realize it. In a famous joke from Moliere's 18th-century play *Le Bourgeois Gentilhomme*, Monsieur Jourdain is astounded and gratified to find out from his philosophy master that for 40 years, he has been speaking prose without knowing it. Activists who think of themselves as uncompromising promoters of efficiency might be just as surprised to learn the extent to which they have always also been unconscious critics of efficiency.

Even the most dedicated efficiency fanatics, for example, are likely to hesitate before endorsing endless improvements in the energy efficiency of moving a tonne of freight quickly around the world. The environmental destruction associated with the extraction and trans-oceanic shipment of oil, coal and minerals, and with consumer demand for out-of-season produce grown halfway across the globe, is too well-known for an abstract "transport efficiency" to be seen by anyone as an unqualified good. Many efficiency enthusiasts will concede, too, that efforts to improve the efficiency of cars must not be allowed to become such a priority that they take away from the attempt to reduce the extent and dominance of the car economy itself.

"Slow-food" enthusiasts, in their self-consciously cheeky challenge to high-velocity "throughput", also work in ways that hem in the rule of efficiency. So, too, do local governments in declining industrial districts who promote low-productivity ecological investment or local employment in labour-intensive basic services for local people.[114] In fact, anti-efficiency elements can be found within even the most gung-ho national efforts to boost economic competitiveness, if only because they are intermittently necessary to safeguard subsistence and jobs. Bringing such examples out of the closet not only helps make explicit their rationality; it also exposes additional conflicts simmering beneath the neat categories of Tables 1-3.

Arguing Using Different Criteria

One reason why arguments about the Jevons Paradox among energy alternatives advocates are so hard to settle is that the different sides do not agree on how they *could* be settled.

Theorists claiming that efficiency is an unqualified good try to narrow the questions raised by Jevons to ones that admit of calculable answers. They ask questions like "How much do consumers' energy bills change after they buy energy-efficient appliances or insulate their homes?", "If you buy a computer with the money you saved by insulating your home or switching to energy-efficient light bulbs, how much extra energy do you need to run the computer?" or "The energy savings achieved by improving grid connectivity equals the output of how many coal-fired power plants?"

Not surprisingly, the answers to such questions tend to be reassuring. For example, the energy bill for running a new computer bought with the proceeds of energy-efficient practices can be measured to be a relatively small fraction of the cost of the computer itself. And saving energy through improving the grid can result in the construction of new power plants being delayed by a measurable number of years. It seems that the savings achieved through efficiency, by and large, are not spent on more energy after all! Admittedly, the computer might embody, or its use result in, energy expenditures not reflected in its energy bill; and the improved grid connectivity could indirectly lead over the long term to new forms of manufacturing with their own energy inputs. But such society-wide effects have never been systematically quantified. From this it is concluded that they have "never been observed".[115] In fact, it's not even clear how experts would go about observing them. "You can't run experiments, after all, or examine a separate world where energy intensity stayed the same. You can only construct models and make educated guesses."[116] All in all, therefore, Jevons effects are "unclear or minimal."[117]

Efficiency critics like David Owen, author of *The Conundrum: How Scientific Innovation, Increased Efficiency and Good Intentions Can Make Our Energy and Climate Problems Worse*, use a different methodology to arrive at the opposite conclusion. For Owen, not only have society-wide Jevons effects been observed; "you can find them almost anywhere you look: they are the history of civilization",[118] manifest in the emergence of new efficiency-enabled products, higher rates of extraction of minerals, and so forth. Critics such as Owen could easily maintain that the impossibility of quantifying the most important Jevons effects – precisely or imprecisely – is not an argument for their nonexistence: their significance can be assessed by weighing the plausibility of various historical narratives. Even on the most conservative assumptions, as economist Blake Alcott notes, "promoting energy efficiency itself will probably not reduce energy consumption."[119]

Both sides tend to agree that capital accumulation is constituted in part by the attempt to produce more with less. But they view the outcome differently because of the different styles of analysis they use, and as a result also offer different prescriptions. For US energy guru Amory Lovins, the debate about efficiency can be settled by quantitative methods. Any concern about absolute increases in energy use can be relegated to "different" debates about wealth or economic growth.

For figures such as Ted Nordhaus, Michael Shellenberger and David Roberts, on the other hand, the fact that economic growth and energy efficiency are "not unrelated" and "not independent" means they must be part of the same debate.[120] For ecological economists Mario Giampietro and Kozo Mayumi, formal quantification, unable to "see" the importance of the Jevons Paradox, is simply incapable of predicting "optimal courses of action".[121] It is only by embedding carbon-saving measures in a broader political movement that gives pride of place to plausible narratives of progressive change that they become effective.

If technocrats still find it hard to acknowledge these conflicts, that may be partly because the efficiency concept has become confused with older, more widespread notions that are, in fact, profoundly anti-efficiency: those of frugality or good housekeeping. What commoners tend to see in getting more from less, or not being wasteful, is to use no more than you need for each unique, limited provisioning task, whether baking a loaf of bread, making a cup of coffee, or feeding your village, given particular social contexts, norms of generosity and other ways of living. From this perspective, a gap becomes visible between efficiency and, for example, the more general concept of effectiveness. Efficiency implies effectiveness only of a particular kind: essentially, effectiveness at maximising the use of resources for capital accumulation whatever the social context and without regard to factors such as norms of generosity. But it tends to entail ineffectiveness – indeed, destructiveness – at defending subsistence and ways of life in particular locales.

A compact flourescent light bulb can help defend subsistence – or it can help expand a system of waste and exploitation.

A concern with the proper use of tools in particular subsistence contexts, by the same token, is generally opposed to a concern with the efficiency of the same tools. What capital sees in getting more from less, or not being wasteful, is abstract *production* of more from less, without necessarily any limit other than, perhaps, equally abstract, expert-defined geophysical, ecological or legal ones – and certainly no deliberation on the nature or necessity of the tasks being done.

Efficiency is also sometimes defended as being the "way of nature". Animals and plants are extolled for being more thermodynamically efficient than machines or houses, or for providing a model for extracting useful information from their environment with a "minimal waste of energy".[122] Biological organisms are implicitly compared to industrial processes on efficiency grounds ("Plants that get their energy directly from the sun . . . are the most energy-efficient organisms on the planet";[123] "the blue whale is possibly the . . . most energy-efficient mammal alive, as their method of feeding can take in over ninety times as much energy as they expend getting that food"[124]) and even biological evolution evaluated as if it were a process toward "greater efficiencies". The superiority of bicycle transport, similarly, is clinched by the finding that a person on a bicycle is more "energy-efficient" than a sturgeon of the same weight would be.[125] There is a confusion here, too: roughly speaking, between what bacteria or orangutans do and the optimization of the use of "scarcified" resources destined for capital accumulation.

Indeed, one reason the concept of efficiency shines so brightly in industrialized societies may be because it has become an omnibus term for a diverse, nearly uncontested range of virtues and attributes associated with living in a subsistence society or surviving as a plant or animal; with using just enough according to local norms; with avoiding extravagance or waste; with preventing unnecessary expense or effort. At the same time, a deep historical opposition remains active even in the most industrialized societies between the "enoughness" of efficiency and the "enoughness" of good housekeeping. When the two concepts are treated as exchangeable (out of acquired industrial habit, reinforced by laziness or calculation), the positive charge associated with good housekeeping gets attached to efficiency as well. Once that habit or laziness is overcome,

efficiency loses a lot of its lustre, and anti-efficiency a lot of its shock value. Technocrats may then find it easier to get in touch with their inner "anti-efficiency" selves.

In his essay "The Gospel of Global Efficiency," German thinker Wolfgang Sachs shows how the two concepts of efficiency and good housekeeping are jumbled together in the work of Amory Lovins, a leading US energy alternatives visionary whose Rocky Mountain Institute is represented in Table 2. Lovins, Sachs recounts:

> "presented his audience with two light bulbs. The lights were equally bright, although the conventional model used 75 and the new one only 18 watts. He explained: 'We should get used to seeing the purchase of an electricity-saving device like constructing a tiny power plant in the home. The new bulb, in fact, is producing 57 negawatts, i.e., unused watts. And the saved electricity can be sold to another client, making new power plants superfluous'."[126]

In this way, Lovins translated good housekeeping – an ideal of subsistence-minded households from Milwaukee to Mumbai – into a form of production and investment. The sociable, prudent impulse to treat an interesting new technology as a way of saving, or of not using more than necessary, was identified with the drive for profit and indefinite growth. Householders' frugality (perhaps even their desire to curb global warming) was run together with the accumulation imperative.

As Sachs notes, this confusion does an enormous amount of political work. Utterly persuasive at first hearing for most industrial-society audiences, it helps entrench a new "common sense" that sits inside and parasitizes the older one. In practical terms, the confusion helps justify, for instance, alliances between private corporations and environmental groups who offer them free consultations on efficiency measures. In the process, the deeper antagonisms between good housekeeping and efficiency are masked. This becomes evident particularly in commons regimes:

> "The point of good housekeeping is not economising for the sake of investment, but saving for the sake of independence. Food is stored, tools are carefully maintained, furniture is handed down from generation to generation. Necessary possessions are fully used, while outside purchases are kept to a minimum. Each coin is turned over twice before it is spent, each transaction is carried out prudently, sometimes even with misgivings."[127]

While saving "intends to keep market involvement at a low level in order to shield the domestic economy against pressure from the larger economy," efficiency "has nothing to do with keeping expenses down, but aims at obtaining a higher return in order to liberate funds for further investments":

> "Efficiency looks for opportunities, saving looks for security . . . These attitudes can easily come into conflict as soon as a gain in efficiency requires money; the Indian peasant may, therefore, prefer to burn piles of cow dung, which involves no money expense, rather than buy a biodigester, although it uses less cow dung to obtain the same amount of heat."[128]

A compact florescent light bulb, like many larger-scale efficiency technologies, is a confusing object because it can be attractive from both

frugality and efficiency perspectives. In the context of electrified societies, it can appeal to commoners because it symbolizes movement toward greater self-sufficiency, independence and opportunities for mutual survival. Yet insofar as it is merely frugal, or oriented toward defending subsistence, it is not efficient, because it fails to foster investment and accumulation. And insofar as it is efficient, or attractive to business, it is not frugal, because it contributes to the expansion of a system characterized ultimately by exploitation and waste. Even more confusingly, the contexts in which the bulb is frugal and those in which it is efficient typically overlap, making it pivot constantly between the two orientations. Businesses may buy energy-saving lightbulbs for efficiency reasons, homeowners for reasons of frugality or conviviality; the manufacturer may have little choice but to try to appeal to both.

To question efficiency is not to refuse to look for energy savings, but to create space to debate what kind of society people want.

Yet the example does demonstrate the existence of spaces in which it is possible to be both anti-efficiency and receptive to innovations such as energy-saving light bulbs – indeed, spaces in which such technologies are adopted neither because they are efficient nor because they are inefficient. Although such spaces are hidden from view on a Lovins-like perspective, their identification and defence constitutes part of the "ability to preserve diversity" that ecological economists Mario Giampietro and Kozo Mayumi identify as a prerequisite for societal survival.[129]

To question efficiency as an energy alternative, accordingly, is not to close off inquiry into how energy savings can be made, but to create space for analysis of the dynamism of capital accumulation; not to repress ingenuity in finding ways to do more with less, but to open opportunities for innovators and the public to debate openly what society they want to have rather than steering them toward concentrating only on means for achieving growth. Historically, energy savings have usually not been about efficiency, but about creativity applied to subsistence, as when developers of homegrown biogas stoves, through trial and error, find ways of crafting burners that are more and more sparing in their use of gas given the size and shape of the pots with which they are used, the type of rubber hose and metalwork tools available, and so forth. One analogy might be elegance in writing. Finding passages that can be cut, writers do save space; but the important thing is that they discover new connections and arrangements of ideas in the process. The objective is not to produce more with less. The objective is not to produce more at all, but to make the writing better.

Who are the Innovators?

If efficiency skeptics need not be hostile to technological novelty, they are, nevertheless, likely to have a differently-shaded image of inquiry than, say, the Rocky Mountain Institute, or governments keen to stoke the "white heat of innovation" that, in their minds, ensures international competitiveness. Communities with experience at the sharp end of the increased extraction efforts that, all too often, are the ultimate outcome of efficiency improvements may be hesitant to view university-educated, lab-coated innovators devising smart ways of boosting the output/input ratios of industrial or household processes as the paradigm embodiment

of intellectual freedom. For them, it may be other figures whose freedom to inquire and innovate needs more protection.

One example might be discussion leaders guided by the principle, articulated by the Iroquois people of North America, of trying to help communities imagine stories that would enable them to think through the consequences of present actions on their descendants seven generations into the future. Another example might be the millions of individuals worldwide who continue to inquire and innovate driven not by a concern with industrial productivity but rather (to quote the words of the 12th-century cleric Hugh of St. Victor) "the desire to pursue further what has been tasted and has been found pleasing," including the improvement of tools for subsistence, comfort and the remediation of various human weaknesses and human-caused disruptions in the environment: what social critic Ivan Illich called science by people rather than science for them.[130] Thus when the Thai villagers in Surin province quoted earlier adapt newfangled biogas generators or improved cooking stoves for their own use, it is not to make labour more productive per unit of Big-E Energy applied, nor to "develop" their village, nor to increase their consumer spending, but in the service of their own practices of enoughness: "so that only the very least possible is used."[131]

What kinds of innovation are most important?

Figures oriented toward a different conception of innovation are not only to be found in indigenous or peasant communities. They can also be fleetingly glimpsed in the background of many industrial scenes described in a technocratic idiom:

> "Any social system in its process of evolution has to decide how to become a different system while maintaining its own individuality . . . The 'feasibility' of this process – changing the structure of an airplane while flying on it – depends on the nature of internal and external constraints facing the society. The 'advisability' of the final changes . . . will depend on the legitimate contrasting perceptions of those flying on it, their social and power relations, and the ability expressed by such a society to make wise changes to the plane at the required speed . . . It is difficult to find an agreement on the set of the most important features to preserve or to enhance when attempting to build a different flying airplane. This has to do with how to define efficiency now. But this decision has to be taken without having reliable information about the feasiblity of the various possible projects to be followed . . . the definition and forecasting of viability constraints is unavoidably affected by a large dose of uncertainty and ignorance about the possible unexpected future situations."[132]

From this perspective, the idea that questioning efficiency could be considered shocking or repressive is merely more evidence for how narrow the energy alternatives debate currently is.

Lurking inside the energy efficiency discussion, in other words, are profound, often-ignored conflicts about what counts as knowledge, effectiveness, research, innovation and policy expertise. On one view, thinking about alternative futures can be safely founded on ideals of prediction, surveys, control, domination, commensuration and maximization. The bulk of the intellectual challenge of policymaking is seen to lie in the expert elaboration of technical choices each of which must

"add up", and of innovation in specialists' finding ways of getting from a preconceived A to a given B. Deliberation over societal ends and how they evolve is passed over in favour of analysis of demand scenarios. Inquiry into the dynamics of capital are eliminated in favour of manipulation of a set of rudimentary arithmetical relations. Democratic decisionmaking, meanwhile, is simplified down to the vestige of a multiple-choice question featuring different expert-delineated scenarios.

On another, more complex view, thinking about alternative futures is more openly acknowledged to be grounded in imagination, conversation, mutual adaptation and reasoning about ends at the same time as means.[133] Understanding that the technological past is incommensurable with the technological present, and the technological present with the technological future, adherents of this perspective look forward to a type of policymaking that does not pretend to be founded on calculation or individual "values", but rather explicitly and publicly compares narratives in a way that highlights the contingency of evolution and the interaction of different actors, cycles and pathways. Quantification's role is reduced to one of helping ensure that each possible story about the future is internally coherent, while wide-ranging and continuous democratic discussion becomes methodologically essential throughout the research, innovation and policymaking process, being central to deliberation over ends, analysis of how they might change, and the collection, evaluation and weighing of different possible stories about the future.

The different stories underlying demand projections and other policy calculations need to be evaluated democratically.

The two perspectives differ sharply not only in their views of the relation of the present to the future, but also on what counts as serious intellectual endeavour. It is not only that, on an economic model of policymaking, proposals to refocus "technology" on improving tools for subsistence are seen as an "unproductive" waste of human brainpower. In addition, the attempt to imagine different stories of societal evolution down to the seventh generation is likely to seem an imprecise, unwieldy, speculative and limiting basis for planning, encouraging conservatism and indeed presenting so many incomparable choices that the result is a paralyzing inertia. How can professional policy analysis possibly be founded on inviting laypeople to invent and try to compare what are acknowledged to be a bunch of fictions? On this view, it is energy demand models, direct rebound effect calculations, regression analyses and the like that form the framework within which politicians must act and which will lay the ground for any consultation with the public that might become necessary later. Any hint that such calculations are subordinate and subsequent to narrative in the structuring of choices about the future (not to mention shaped by the influence of industrial and finance lobbies or any other interest group) signals disrespect for fact and science.

On a contrasting perspective, the improved awareness of ignorance and uncertainty that becomes possible when the central role of comparative storytelling is acknowledged is a practical guarantee against hubris.[134] On this view, it is only through making the narratives underlying each set of policy calculations explicit, and carefully formulating others against which they can be evaluated in what is unavoidably an unrelenting power struggle (*see "*Overcoming Blocks to Dialogue", p.70), that the future can be opened to rational debate. Thus the narrative basis of many of the technocratic alternatives of Tables 1-3 – which consists in many cases

of nothing more than a single naïve tale of economic growth in which more efficiency brings less energy use – escapes the cleansing touch of rational examination by hiding its threadbare, implausible character under gaudy cloaks of calculations, as well as by falling back on John Maynard Keynes's famous but lazy dismissal of narrative quality control: "In the long run we are all dead." From this viewpoint, what invites inertia is not the struggle to unleash communal imaginations in order to look ahead to the seventh generation, but rather acquiescence in the mystification that the contours of whatever future is relevant have already been decided by economic predictions – another name for unsophisticated stories dressed up with quantification and functioning as mythologies of accumulation.

Third Divide: Different Conceptions of Politics

A third divide implicit in Tables 1-3 – a conflict over political process and methods – follows on closely from the divide between simplistic and entangled approaches toward energy alternatives. Where proposals for energy alternatives take on more complex questions, they also tend to become more explicit about the political narratives they presuppose and the political processes through which they would need to be understood and tackled. And the more explicit these political processes become, the more clearly the differences emerge among how the participants in different initiatives conceive of political deliberation and political action with regard to issues such as technological change, the relationships between humans and nonhumans, and energy crises. For example, while the Rocky Mountain Institute simply sets aside the question of economic growth in its encouragements to business to find ways of engineering increased efficiency into industrial and household processes, efficiency critics counter that a debate about the dynamics of capital accumulation is essential.

But the divide over political methods goes deeper still. One of the biggest conflicts is between initiatives that treat politics and society as separate from technology and those that treat them as constituting each other.

Technology Reified

US energy specialists Mark Jacobson and Mark Delucchi provide a good introduction to the view that society and technology are separate. They state that "barriers to a 100 per cent conversion to wind, wave and solar power worldwide are *primarily social and political, not technological or even economic*".[135] Another pair of energy experts, Benjamin Sovacool and Charmaine Watts, argue that, with respect to the possibility of generating all electricity needs renewably, "it is not the technology that is lacking, but the political will, institutional inertia, and social awareness needed to bring it forward."[136]

Such statements are well-intentioned. They attempt to debunk the widespread idea that an energy transition is technically impossible, and so to open up hope for immediate action. They give heart to anyone who recognizes the urgent need to phase out fossil fuels and oppose nuclear technologies. But in doing so, they also reproduce a highly controversial approach to politics that has its own regressive, constricting and anti-environmentalist tendencies – and is in conflict with that of many other participants in the energy debate.

What is perhaps most striking is the concept of technology used in such proposals. For ancient Greeks, *mechane* meant the outwitting of nature. For medieveal scholastics, it connoted artful imitations of nature. For the 12th century thinker Hugh of St. Victor, as Ivan Illich records, it was possible to see scientiae *mechanicae* as "reflections on specific remedies for bodily weakness – weaving, metalwork, agriculture" – in all of

which wisdom is hidden.[137] In the 17th century, the term "technology" itself emerged, connoting a study of the "arts", and in the 18th century became associated with a sense of "science for production" (rather than, say, Hugh's sense of "science by people"). Still, up to the earlier 20th century, "technology" could still refer, in German and French, to critical analysis of the relationship between people and tools. Later this meaning was reduced to something like "techniques".[138] Now, as in most of the proposals of Tables 1 and 2, "technology" signifies, above all, certain kinds of physical objects. "Technology", in short, has become professionalized, made abstract and finally fetishized into a set of physical things set apart from human society.

Stone Soup and Machine Fetishism

Anthropologist Alf Hornborg explains "machine fetishism" by means of a famous story from European folklore:

> "A hungry tramp is reluctantly admitted into a rural kitchen, but the housewife has no intention of serving him any food. He pulls a stone out of his pocket, asking merely for a pot of water to boil some soup on it. The housewife is too intrigued to deny his request. After a while, stirring and carefully tasting the water, the tramp observes that the soup might be improved with some flour, as if this was the only missing ingredient. The housewife, still baffled, consents to offer him some. Then, one by one, he similarly manages to lure her to add the various other ingredients, until finally she is amazed to find a delicious soup cooked on a stone."

"In transferring attention from the wider context to its imaginary centre," Hornborg observes, the "stone in the soup is the prototypical fetish":

> "Fetishized objects are in an important sense constitutive – not just misrepresentations – of accumulation and power. They are visualized as intrinsically generative or productive, and they are indeed responsible for processes of accumulation, but only by orchestrating them, whereas this orchestration itself hinges precisely on obscuring their social basis in unequal exchange. No more than the stone contributed to the soup is a fetishized sacred king like the Inca emperor the source of his people's affluence. Similarly, the industrial machine . . . is but a fetishized node in a global system of resource flows. If those flows were to cease, the machine would grind to a halt."[139]

What are the consequences of this shift? Closer examination shows that it not only fosters certain critical kinds of ignorance, but also gives rise to unrealistic visions of the future, discourages important political alliances, and weakens social movements for the kind of change demanded by the crises associated with fossil fuel use.

Technology Meteors

In industrialized societies, the idea that machines have a life of their own is visible everywhere in everyday life, having perhaps reached a sort of apotheosis in mid-20th century US visions of salvation through technological advance.[140] In the 1960s, visitors to GM's Futurama 2 Pavilion at the New York World's Fair left an exhibition filled with visions of six-wheeled moon buggies, undersea hotels and tree-devouring machinery carving highways through jungles with a badge proclaiming, "I have seen the future".[141] The future they had seen was one that seemed almost to have been created by technological objects themselves. Technology was portrayed as being largely autonomous from society, with new inventions appearing out of the blue to usher in inevitable, irresistible change in a largely pre-determined direction.

This vision has never gone away. It still appears in humble dioramas of future "technological life" constructed for provincial fairs in India. It is engraved onto Lao banknotes, with their depictions of hydroelectric dams transforming the countryside. And it is reproduced in the daily rountines of economists, government officials and many other intellectuals throughout the world. Most economic models of possible policy responses to climate change, for example, assume that technical change is an "exogenous variable": that is, it "just happens" in ways that do not depend on other factors.[142] Technologies "emerge". The problem of nuclear waste "*will*" be solved. Ways "*will*" be found to sequester and store the carbon dioxide emitted from coal and oil-fired power plants. The use of energy "*will*" become progressively more efficient. All that is needed to bring the technologies into being is a bit of human ingenuity and volition.[143]

But, as social historian David Nye observes, "Machines are not like meteors that come unbidden from the outside and have impacts."[144] They are adopted and used in a matrix of social, economic and political relations that, while binding and dividing people, erode any hard distinction between technology, on the one hand, and society on the other. Every machine is "an extension of human lives: someone markets it, some oppose it, many use it and all interpret it".[145] No technological system should therefore be viewed as an independent, implacable force moving through history; "each is a part of a social process that varies from one time period to another and from one culture to another".[146]

The deployment of wind power, for example, varies enormously from country to country and even within countries – a variation that cannot be explained by differences in the type of wind turbines used. In Germany, for example, resistance to wind farms has been muted, while in the US and UK it has often been fierce. The likely explanation may lie in ownership patterns: in Germany, half of all wind projects are community-owned and -financed, whereas in the US (where only two per cent of wind projects are community-owned), wind farms are largely funded by "banks, corporations and hedge funds – outside investors that find ideal locations for wind or solar, try to convince the local community and end up with a NIMBY ["not in my back yard"] problem".[147] Similarly, it was politics, not merely a somehow-independent "technology", that determined the different histories of transportation systems in the US, where public subsidies were captured to promote private car use, and Europe, where public investment has (until recently) been directed more toward the development of public transport.[148]

"Technology" is often depicted as a force independent of society.

If Austria has the world's only nuclear power station never to have been put into operation after having been constructed, it is not because the technology there differs substantially from that used in nearby France (where 78 per cent of the country's energy is generated by nuclear power), but because the Austrian people successfully opposed the economic and political forces seeking to promote a nuclear Austria and won a legal ban.[149] Other countries that have rejected nuclear power include Australia, Denmark, Greece, Ireland, Israel, Italy, Latvia, Lichtenstein, Luxembourg, Malta, Portugal, New Zealand and Norway. Germany, Japan and Switzerland, which all have existing nuclear power plants, have also now turned their backs on the technology.

Especially when driven by what technology scholar Langdon Winner calls "the desire of some to have dominion over others", technology also often develops in strikingly inefficient directions.[150] Winner cites research by historian Robert Ozanne into the adoption of expensive and untested pneumatic moulding machines by Cyrus McCormick's reaper manufacturing plant in Chicago in the mid-1880s.[151] The standard economic interpretation, Winner says, "would lead us to expect that this step was taken to modernize the plant and achieve the kind of efficiencies that mechanization brings". But a broader view reveals that McCormick was engaged in a battle with the National Union of Iron Molders. "He saw the addition of the new machines as a way to 'weed out' the bad element among the men," namely, the skilled workers who had organized the union local in Chicago. The new machines produced inferior castings at a higher cost than the machine they replaced – but could be handled by unskilled labourers. "After three years of use the machines were, in fact, abandoned, but by that time they had served their purpose – the destruction of the union."[152]

"It takes a lot of hard work by a lot of dedicated people to make the inevitable happen."

Joseph Kaselow
Advertising columnist
New York Herald Tribune

A 20th-century automated machine tool system, historian David Noble found, was also rejected mainly because it "left control of production in the hands of skilled workers, rather than in those of managers or programmers".[153] Treating technology as "self-defining and independent of social power", rather than as being shaped by "institutions, ideas and social groups, operating in a context of class conflict", Noble warns, threatens to "derail" the potentially liberating use of alternative technologies. It may even help transform them into "further, perhaps more subtle, means of domination".[154]

Whether it increases efficiency or not, the development of any given technological object may well appear in retrospect to have been "inevitable". But as Joseph Kaselow, the advertising columnist for the *New York Herald Tribune*, once remarked of robotics in manufacturing, "it takes a lot of hard work by a lot of dedicated people to make the inevitable happen".[155] There was nothing inevitable, either, about the emergence of the internal combustion engine as the prime means of powering cars today. In the early 1900s, the majority of cars were either steam-driven or electric: petrol-driven cars were the least popular, not least because there were few petrol stations or mechanics to service them.[156] It took Henry Ford's mass production of low-priced, petrol-fuelled cars to spur the development of the service industries needed. And, as that service infrastructure grew, it edged out others: "By 1920, an extensive service system existed only for one kind of automobile, and the others soon disappeared".[157] Similar stories could be told of other technologies, such as pesticides and other oil-based agrichemicals, whose dominance was achieved in large part through dispossession of "backward" farmers, the capture of agricultural extension services by agribusiness companies, and the use of fiscal and other measures to push farmers into adopting "modern" chemical agriculture.[158]

The fetishising, "meteor" view of technology, in short, writes out of the story nearly everything that matters in shaping struggles over what objects are used for what purposes. Missing is the story of the construction of the political relationships necessary to secure research and development

subsidies and other forms of government support for a particular technology (witness the vital role that securing taxpayer dollars for building the US highways system played in the development of private automobile travel and the squeezing out of public transport in the US).[159] Missing is the story of the advertising and other strategies that have to be brought into play to create or nurture a "need" for a specific product. Missing is the story of the physical infrastructure that must be lobbied for and built before a technology can "take off", as well as the story of the bribes, pork-barrel legislation and regulatory exemptions that have to be arranged before permits are issued or finances are forthcoming. Missing, too, is the story of the complex negotiations between companies, bureaucrats and ordinary people that ultimately shape the use of a given set of mechanical contraptions, and of the public relations campaigns that have to be designed and rolled out to manage public debate around them.

Technology as Unmoved Mover

Editing technological stories in this way encourages the idea that isolated technological objects are the unmoved movers of history. Technological objects are often said to "impact" on "society" and "have implications" for everyone's lives, but, mysteriously, are somehow never themselves "impacted upon" or treated as "implications" of anything else. Instead of technological society resulting from a complex set of unequal negotiations among varied groups of humans and nonhumans, particular social formations come to seem the outcome of the presence or absence of given machines, which are credited with the power to bring about even more changes all by themselves.

Technological processes are often said to "have social implications", but, mysteriously, never seem themselves to be "implications" of anything else.

In the 1940s, for example, proponents of nuclear reactors advertised them as ushering in an age of "unparalleled richness and opportunities for all", where "privilege and class distinctions and other sources of social uneasiness and bitterness will become relics because things that make up the good life will become so abundant and inexpensive".[160] Modern-day genetic engineering companies likewise claim that certain laboratory processes will end hunger, ignoring the broader political causes of famine and malnutrition. Similarly for discussions of alternative energy. Until recently, windmills and solar panels were often described as if they would inevitably lead to decentralization of power generation, which in turn would blaze a path toward the rebuilding of local economies.

Along similar lines, bringing "modern energy" to 3.5 billion people who currently live without it is still sometimes portrayed as a magic potion for ending poverty. The International Energy Authority, for example, talks of universal access to energy "heralding" poverty eradication through "reducing infant mortality, improving education, ameliorating gender inequality, attaining environmental sustainability, and accelerating global economic growth and prosperity".[161] Others have even suggested that access to "modern energy" is a pre-requisite for politics itself: without it, claims Practical Action, a UK-based non-governmental organization, "billions of women, men and children will be denied the power to challenge their poverty".[162]

Missing from such simplistic pictures are the complex ways that machines, embedded in a plethora of relationships with living and nonliving things, help open up some possibilities only by closing others; and the ways they can help push the rest of society into a particular elite-influenced trajectory. When energy is produced as a commodity for sale and as a raw material for fuelling the production and exchange of other commodities, its impacts on poverty are multiple and often negative.[163] Indeed, "increasing access to energy" in the context of an unchanged approach to its control, generation, distribution and use can greatly exacerbate poverty. As South African scholar Donald A. McDonald observes in *Electric Capitalism: Recolonising Africa on the Power Grid:*

> "'Business as usual' in the electricity sector will be an environmental catastrophe in much of Africa. From the dirty coal-fired electricity generation stations of South Africa to nuclear waste, to the flooding, siltation and loss of biodiversity associated with hydro-electric dam developments, an unaltered electricity growth path would counter many potential gains. 'Business as usual' would also mean social oppression and forced relocation for hundreds of thousands of people who find themselves in the wake of these infrastructure developments."[164]

Even if such power generating plants were built in ways that minimised their environmental and social impacts, other inequalities would remain embedded in the way the energy is distributed (does it go to large industrial conglomerates or to ordinary people? are some regions favoured over others? do user fees make the energy unaffordable for poorer people?) and consumed (is it primarily used to meet everyday needs? or to promote ever increasing consumption that serves primarily to enrich the few at the expense of the many?). Indeed, to expect "alternative machines" to usher in wider structural change without social movements working to change the political and economic matrix in which they are designed and operated is to ignore the reality that energy embodies a whole political order that, at present, is organized around a process of accumulation that can only produce and reproduce poverty. As author and activist Kolya Abramsky observes:

Increased energy provision often makes poverty worse.

> "While technology is, and will surely continue to be, of great importance, the process of building an emancipatory post-petrol energy system will not be the inevitable result of technological fate. If such a system is to emerge, it will largely be the result of collective human activity and choices, intentional or otherwise. There is no single 'transition' process waiting to unfold that already exists in the abstract. Multiple possible transition processes exist, and the actual outcome will be determined through a long and uncertain struggle."[165]

Politics Hollowed Out

The view that technology amounts merely to techniques of industrial production and consumption – and ultimately to mere mechanical objects – is at home in many a contemporary conference on energy alternatives. In such conferences, the topic of the first day might be "available technologies that could meet demand" and of the second, "how to make them a reality". The experts called on to speak on the first day are held to be

neutral with respect to the questions discussed in the second. They may not even mention them. Thinkers like Robert Socolow and Stephen Pacala (Table 1), for instance, might regard it as none of their business how the technologies they describe (nuclear, wind, fossil fuel) come to be shaped or precluded by the resistance of local residents (or of the landscapes they live in) to energy extraction. Nor do the speakers in the second day of such meetings typically challenge the findings of the first: expertise in technology is accepted as a ready-made package whose authority owes nothing to the political sophistication (or lack thereof) of its exponents and can readily be "applied" to this or that political scenario. The idea that politics is something different in kind from technology, in other words, is reflected, embodied and reinforced in the processes through which energy seminars and other forms of politics are themselves conducted.

The fetishistic attempt to dissociate technology from politics, and machines from the social relations of exchange through which their raw materials are extracted, appropriated, transformed and redistributed, has two mirror-image effects. On the one hand, it empowers mainstream technocrats or politicians to claim that questions regarding (say) petroleum reserves and wind capacity can be answered in detail separately from questions regarding health, community conflict, the resistance of geological structures or the political acceptability of energy plans – which are often assigned the role almost of an afterthought or perhaps an "obstacle" to be cleared away. Research programmes in geoengineering or genetically modified energy crops can accordingly be excused, no matter how much momentum they impart to the drive to adopt the technologies, on the ground that they are "apolitical" and that the "political" decisions about whether to implement them have somehow not yet been initiated.

Treating technology as "apolitical" is a way of stifling public debate.

On the other hand, disembedding politics and technology from each other also empowers certain strains of leftist visionary to play the flip side of this record: that is, to insist that technological questions can be settled "after" issues of exploitation or social injustice are negotiated. To more than a few on the left, nuclear energy (for example) is not racist, colonialist or oppressive "in itself"; it is merely an innocent object like a small "hammer" that fits the hand and can be used or misused. The only question is who "controls" it; and, since all machines are nothing more than manageable physical objects, that can be decided without taking into consideration any special or unique features each may have. The idea, in other words, is that "material objects are politically innocent and immune to moral critique."[166] Similarly, the assumption of EcoEquity, echoing that of almost all delegates to United Nations conferences, is that "technology transfer" is a relatively unproblematic currency for implementing the abstract redistributive international agreements that constitute the prior, substantive condition for a just energy transition. Here it is a technology somehow stripped of politics that becomes the afterthought, to be tacked onto whatever negotiations went before.

All such positions, whether associated with the right or the left, tend to render invisible crucial networks and exchanges: in the case of nuclear energy, for example, the political economy of uranium mining and processing in indigenous territories in Australia, the southwestern US or various African countries. In general, they occlude the politics that inheres in the coevolution of humans and nonhuman things, reflecting

an ideology separating "society" and "nature" that science scholar Bruno Latour identifies as a mark of modernity.[167] The degraded vision of politics that results becomes itself a tool of the politically powerful. Lacking a comprehensive picture of the many points of possible political intervention throughout the complex web linking machines, energy flows, money, science, and the obduracy of particular geographies and peoples, movements partly or wholly taken in by this vision often reduce

Dividing Technology from Politics: Absurdity Raised to the Level of the Sublime

Attempts to separate technology from politics achieved a kind of apotheosis in 1989 calculations by the US Department of Energy. According to the Department's figures, the equivalent of 657 trillion barrels of oil, or more than 46,800 times the annual rate of national energy consumption, was "available" within the country's borders in the form of wind, geothermal, solar and biomass resources – a conclusion endorsed at the time by numerous government laboratories and reputable research institutes.[168]

In such exercises, nearly anything that does not violate the laws of physics – solving global warming by shooting sulphur dioxide into the atmosphere, coating deserts with solar generators, redirecting ocean currents – becomes "technically possible" right up to the point when it is shouted down by protesters or ridiculed into obscurity by engineers, politicians or the public.

A UK government-industry coalition called the Offshore Valuation Group, for example, claims that Britain's electricity needs could be met up to six times over from offshore resources.[169] Similarly, David MacKay, Chief Scientific Adviser to the UK Department of Energy and Climate Change, cites the "good news" that "there's enough deuterium to supply every person in a tenfold-increased world population with a power of 30,000 kilowatt-hours per day (that's more than 100 times the average American consumption) for one million years" (although, to MacKay's credit, he does caution that it is "reckless to assume" that the nuclear fusion technology that would make such wonders possible can be delivered).[170]

Such speculative excursions might seem harmless at first. They may not mean much in practical terms, but at least they stimulate the imagination into understanding better that current technological networks are not destiny. But when they become too prominent in discussions about energy alternatives, a different dynamic takes over. Any scheme that might meet abstract demand is suddenly on the table. Exploitation, disruption, ruined livelihoods all become afterthoughts. History, place, even food – everything except big-E Energy disappears into a maw of abstraction, resurfacing only in asides and appendices.

The supposed "depoliticization" of energy information, in short, has a real political effect: disempowering thousands of communities and technocrats alike, depriving them almost even of a language with which to speak about the central issues. Simply by being repeated over and over, mantras like "demand", "scarcity" and "kilocalories" come to denote eternal categories.

Most of MacKay's 366-page book, for example, is devoted to abstract exercises attempting to match even the most implausible scenarios of "sustainable" energy provision to demand. The politically complex issue of how demand itself might be challenged is foreshortened to formulas like "reducing our population", "reducing the energy intensity of our lifestyle", or "changing our lifestyle" itself.[171]

A similar disrespect is evident in Tim Jackson's book *Prosperity without Growth*, as well as the work of "alternative" economist Herman Daly (Table 1, p. 8), where 150 years of subtle political thinking about challenging the dynamics of capital accumulation and unequal energy transfers is replaced by simplistic or moralistic injunctions about "breaking the spell" of consumerism or bald assertions that maybe capital does not need to grow.

Environmental NGOs seeking global energy alternatives are far from immune to the tendency. Thus the World Wide Fund for Nature illustrates its recent *Energy Report: 100 Per Cent Renewable Energy by 2050* with a map in which continents are assigned circles of different sizes according to their potential to supply terawatt-hours. Here land, wind, ocean surfaces and currents, gravity, trees, grass, Shakespeare's "great globe itself", dissolve into uniform thermodynamic work, leaving not a rack behind. With them disappear innumerable languages and lives, making it an ever harder and lengthier task to recover a sense of the world that "energy alternatives" initiatives are presumed to help make possible.

science and technology to apolitical black boxes gifted to the world by experts. As part of the same process, agency is reduced to a contentless "political will" to be exercised by recognized "political leaders" who, it is hoped, will eventually be forced to respond to decontextualized yet mysteriously potent "nonpolitical" information about molecule flows, machines and the risk of flooded cities provided by scientists and technologists.

Hence climate activists such as US writer Bill McKibben claim that in the field of climate change politics, "physics and chemistry call the tune"[172] – implying that an abstract, human-independent "nature" is now at last poised to force politicians to act (with, of course, the assistance of expert and pressure-group mediators). Such a partial vision ultimately helps reinforce the positions of many mainstream political leaders, who are relieved not to have to face any more severe political tests on the global warming battlefield than to have to find ways of ignoring or downplaying warnings of catastrophe voiced by climatologists or by street demonstrators hoisting the banner of "peer-reviewed science".

Politics Revivified

Because it interferes with the political processes that they rely on, the fabrication of thinly-constituted, mutually-independent activities called "science", "technology" and "politics" is most powerfully contested by commoners at the grassroots in the global South and in disadvantaged communities in the North. While this constellation of simplified abstractions provides a useful political vocabulary for energy planning departments or environmental NGOs working to ingratiate themselves with elected officials, communities directly experiencing the deleterious effects of energy extraction, fossil fuel burning, and unequally-distributed energy services are more inclined to treat science, technology and politics as embedded in each other. For them, in a manner of speaking, all politics and all technology is technopolitics.

No community seeking to prevent construction of a large coal-fired power station, for example, can afford to treat it as if it were one among various interchangeable "tools for meeting energy demand". Instead, it has little choice but to analyse the plant – together with the "demand" that justifies it – as an integrated instance of politics of a particular kind. Not only do such plants necessitate, and further the ends of, a political infrastructure associated with centralized resource extraction, exclusionary expertise and large-scale finance pursuing high returns. They also cannot function without reinforcing a politics of inequality. Their economics incentivizes planners to site them, as well as their supply infrastructure, in communities that they believe cannot fight back, or where resistance can be contained or even exploited; the webs of expertise justifying their construction are of necessity relatively opaque to laypeople, facilitating corruption and bureaucratic empire-building; and so on. If the state or private energy bureaucracies promoting such plants are constitutionally unable to discuss the degree to which racism or colonialism are embodied in the steel and concrete used to build them, or inherent in orthodox economic concepts such as "the energy supply curve", "energy scarcity", and so

For villagers from Thailand's Prachuab Khiri Khan, experts' claim to be "neutral" is a joke.

on, affected communities are often quite willing and well-equipped to take on the job.

At the grassroots, particular scorn is often reserved for the idea of a "neutral", politics-free science or technology – a staple of many of the "alternatives" proposals of Tables 1 and 2. The view of the activist villagers in Thailand's Prachuab Khiri Khan province (Table 3) is representative. Without political and social equality, they observe, technocrats' and economists' claim to "neutrality" (*khwaam pen klaang*) calls to mind a scenario in which "an adult and a child get into a boxing ring together and fight it out, with the fight overseen by a referee who scrupulously ensures that all the rules are obeyed."[173] And as local activist and writer Sureerat Taechooprakun recounts, local peoples' home-grown satires of technocrats' claims to be "neutral" in their analysis of energy issues can be even more biting:

> "The villagers say that in this life there's only one thing that's neutral (*klaang*, middle), and that's the [sexual] endowment your father and mother left you, because it's in the middle of your body. So an expert's mention of the word 'neutrality' can always be counted on to raise a smile on a villager's face. Aunties will shout out teasingly, 'So, kiddie (*nuu*), what kind of "neutral" is this, then? Willy or pussy?' Having seen their lives invaded by 'neutrality', villagers see the word as having no meaning unless it is accompanied by justice."[174]

More than a half-century ago, mathematician and comedian Tom Lehrer made the same point using a more delicate North American cultural idiom in his satirical ditty on Wernher von Braun, the Nazi rocket scientist who, after developing the V-2 rocket during the Second World War, was shipped to the US, later attaining fame at the National Aeronautics and Space Administration as an exponent of "politics-free" missile technology:

> "Don't say that he's hypocritical.
> Say rather that he's – apolitical!
> 'Once the rockets are up, who cares where they come down?
> That's not my department,' says Wernher von Braun."[175]

Struggling to Forget

Yet resistance to technology/politics dualisms has never been confined to environmental justice movements and clever satirists. There have been times in the recent past when the temptations of machine fetishism were also contested more effectively even in middle-class environment and development circles in Europe itself.

Prior to the 1980s, many discussions of energy alternatives, even when they dealt with specific technologies, were heavily influenced by the radical technology movement. Rejecting the view that renewable technologies, such as solar or wind, were intrinsically democratic, egalitarian or communitarian technologies, the radical technologists insisted that alternative energy machines could serve as an emancipatory force only where their use and control were linked to wider changes in the distribution of political and economic power. Warning of "the impossibility of achieving social ends merely through technological means", David

Dickson, author of the 1974 book *Alternative Technology*, critiqued those who advocated a "small-is-beautiful" approach to alternative technology without also embracing the politics of technopolitical change. Without "a unity of technological and political practice" and a recognition of "the extent to which technology maintains and reinforces the social structure of which it forms a part", Dickson argued, such approaches were "doomed" to be "swamped" by elite interests. Class matters, he urged, and needs to be directly confronted:

> "When, for example, promoters of intermediate technology declare that the choice of technology is one of the most important choices that a developing country must face, one must ask: choice by whom, and for whom? The economic situation in most underdeveloped countries is determined by the united economic and political interests of foreign capital and an indigenous elite. The rural poor, as non-surplus producers and non-consumers within an emergent capitalist system, are becoming increasingly irrelevant to the political process. Any claim for the democratic choice of technology in such situations has a very hollow ring about it indeed. What is often meant is that the choice is one that faces foreign aid and investment bodies, and the concepts and ideologies that support them; it is a political as much as a technological question, and to view it solely as the latter is but one further example of ideological distortion."[176]

It was widely understood in the 1970s that without deep social change, "alternative" energy would still end up degrading the environment.

Much of the debate in the 1970s and early 1980s was also framed within a wider set of concerns over the impacts of an ever-expanding economy. As governments began to support renewables in the wake of the 1973 oil crisis, many environmentalists voiced concern about what Peter Bunyard of *The Ecologist* magazine called "the coal-equivalent mentality"[177] – the demand that energy alternatives (whether solar, wind, wave, water or indeed nuclear) be capable of generating the "same amount" of an abstract "energy" as coal or oil or gas, thus ensuring that accumulatiion could continue uninterrupted. In a prescient critique of the "solutions" that the next generation of environmentalists would soon be proposing, Bunyard castigated the:

> "increasingly incredible ideas being bandied about which claim that alternatives will salvage industrial society . . . solar farms in the desert, tens of thousands of giant windmills straggling the hilltops, energy plantations, huge constructions out at sea for capturing wave power and solar satellites fifty kilometres across, which beam the sun's energy in microwave form down to earth."[178]

Fixated on ensuring maximum output of energy, Bunyard argued, proponents of madcap green schemes ignored the reality that "alternative" energy, if employed to fuel "the roaring furnaces of industrial society", with its insatiable demand for ever increasing consumption, would still wind up degrading the environment.[179] The task was to change society, not just the machines delivering its energy supply.

As environmental and development groups went mainstream, however, and sloughed off much of their critical skins, they became less inclined to engage in this kind of strategic thinking. Instead of organising to challenge dominant institutions, they tried to fit in with their politics.

Entranced by the notion that power is a singular "thing" that a small minority ("the powerful") eternally "have" and that others – the vast "powerless" majority – eternally "lack", they viewed the task of campaigners as opening the eyes of "the powerful" to the problems that their policies and programmes were causing. Once aware of those problems, "the powerful", it was hoped, might take corrective action; and if they did not, all the better: lobbying opportunities would then multiply indefinitely into the future. Campaigning thus became a profession dependent on extending the lifespans of crisis-ridden institutions ranging from the World Bank to hedge funds, from Shell Oil to McDonalds.

In the case of energy alternatives, the biggest challenge is accordingly today often viewed as finding responses to the official objection that renewables cannot "keep the lights on". New forms of storytelling have emerged, consisting of briefs for ministers on how to match supply and demand, tramlined "talking points" for lobbyists, and computer models of energy needs and generating capacity.[180] The aim is the opposite of challenging dominant economic and political networks of power: the environmental group World Wide Fund for Nature describes its mission as "wanting to help change the 'old' paradigm for the energy industry and articulate a new pathway for the future".[181] The task is to galvanise the "political will" to reprogramme the machine – in this case by replacing polluting fossil-fuel Big-E Energy by green Big-E Energy.

The self-styled "pragmatists" of mainstream environmentalism have been anything but pragmatic – they have weakened popular forces for change.

In the effort to persuade finance and industry to "come on board", many large environmental groups have often let whatever ties they might have had with grassroots activists, radical trade unionists and other groups working for structural change in society come unraveled. As the US journal *Foreign Affairs* notes of the US environmental movement, it is now "politically incorrect to suggest that going green will require even the slightest adjustment to our way of life".[182] As class has largely been erased from discussions of energy alternatives, and the "coal-equivalent mentality" returned to prominence, anything that might jeopardize alliance-building with the imagined "powerful" of society is deemed unhelpful.

Far from building practical alternatives, the self-styled "pragmatists" of mainstream environmentalism have weakened movements and left many campaigners stranded. Without an integrated analysis of accumulation and the role that Big-E Energy plays in maintaining existing structures of privilege, they are trapped in the limited (and limiting) space of "machine choice". They can propose alternatives to various machine networks, but not alternatives to the direction that society is taking, which is simply taken for granted. They can critique proposals to build this coal-fired plant or that nuclear station, but forever have to propose or endorse alternatives that produce (or save) the "same amount" of energy, without questioning the dynamics of and uses for that type of energy. They can argue over the siting and construction dates of energy projects, but stay forever on the defensive about whether or not the projects will eventually be required, since the assumption that the demand for energy is endless remains unchallenged. The possibility of extended dialogue with movements supporting other energy practices remains not only unexplored, but carefully unacknowledged. "We can have our cake and eat it" is the

unspoken slogan, obscuring the fact that the cake being eaten is usually someone else's – if it is there to be eaten at all.

In the Grip of Obsession

In taking this stance, many mainstream environmental groups have unquestionably become highly skilled at exposing various technical fantasies, such as that solutions can be found to the problems of long-term storage of nuclear waste or to the intractable difficulties of carbon capture and storage. But insofar as this critical spirit limits itself to finding alternatives for industry and government, it tends to leave ordinary people in the lurch; and insofar as it focuses on finding Big-E Energy alternatives, it tends to neglect the development of the alternatives *to* Big-E Energy that common sense increasingly mandates. As a result, mainstream environmentalists' alternative energy proposals often turn out to be as unrealistic as the official visions they criticize. Once drawn into the notoriously tricky game of matching projected supply with projected demand (even in their own terms, demand forecasts have almost invariably turned out to be not just wrong, but wildly wrong),[183] even the most well-intentioned and ordinarily-conscientious energy specialists quickly find themselves constructing fantasy supplies to meet imaginary demands.

Obsessed with finding big-E Energy alternatives, mainstream environmentalists tend to neglect the development of alternatives TO big-E Energy.

Hence the obsession, visible especially in Tables 1 and 2, with locating machines – any machines, as long as they look "green" – that might drastically reduce or eliminate fossil fuels as an energy source within the next 50 years while still enabling the global economy to expand. As Ted Trainer of the University of New South Wales, himself a proponent of renewable energy, comments, even renewable energy experts, the "people who know most" about carbon-free industrial or household machinery networks, do not necessarily offer helpful advice when in the grip of this obsession:

> "They have a strong interest in boosting the potential of their pet technology and in not drawing attention to its weaknesses, difficulties and limits. Exaggerated, misleading, questionable and demonstrably false claims are often encountered in the promotional literature. Minor technical advances which might or might not become significant in the long run are announced as miraculous solutions. Doubts regarding the potential of renewable technologies are rarely if ever heard within these fields."[184]

Two of the alternative proposals from Table 1 illustrate the difficulty. Although the majority of the scenarios considered by the Intergovernmental Panel on Climate Change predict that renewables will provide a mere 27 per cent of global energy by 2050 (with the best-case scenario suggesting a figure of 77 per cent),[185] the World Wide Fund for Nature (WWF) report confidently states, "By 2050, we could get all the energy we need from renewable sources"[186] while maintaining economic growth.[187] Under the WWF plan, energy efficiency programmes would be used to reduce demand to 85 per cent of 2005 levels, while wind, solar, biomass and hydropower would take over most energy

production. Solar and geothermal, as well as heat pumps, would also be used for heating buildings. Biofuels, covering 250 million hectares, or one-sixth of global cropland, would be used to supply 60 per cent of the liquid fuel needed for "aviation, shipping and long-haul trucking".[188] A worldwide network of smart grids, linking the Americas to Africa, Europe and Asia, "to store and deliver energy more efficiently", would interconnect this new world,[189] allowing Europe to draw its power from wind turbines and wave machines in the North Sea, Alpine hydropower and solar power from the Mediterranean and even North Africa.[190]

Similar conclusions are reached in Mark Jacobson's and Mark Delucchi's proposal for moving to 100 per cent clean energy globally over the next three and a half decades. Unlike WWF, Jacobson and Delucchi exclude not only fossil and nuclear energy sources, but also biofuels,[191] envisaging all new energy generation coming from wind, water and solar by 2030, and all pre-existing fossil energy production being converted to renewables by 2050.[192] Wind and solar would provide 90 per cent of energy needs, with the rest coming from hydroelectric, geothermal, and wave and tidal power. Hydrogen-powered fuel cells would be used to fuel cars, trains and ships, while aircraft would run on hydrogen. The plan calls for 3.8 million large wind turbines, 90,000 solar plants, 720,000 wave devices, 5,350 geothermal plants, 270 new large dams, 490,000 tidal turbines, 1.7 billion rooftop photovoltaic (PV) panel systems, 40,000 solar PV plants and 49,000 concentrated solar plants.[193] As in the WWF plan, a supergrid would be required to network the different forms of energy generation, combining their output into "one commodity" (electricity) that could be transmitted through power lines to match demand.[194]

It is often said that energy needs can be met renewably by existing technology. But what is meant by "existing"?

Unsurprisingly, such proposals do not always hang together even in their own terms. On page 79 of its 256-page *Energy Report: 100 Per Cent Renewable Energy by 2050*, for example, WWF admits that, on its calculations, five per cent of energy in 2050 would still have to be supplied by coal – necessary for some industrial processes such as steelmaking. A more important difficulty, however, revolves around the claim often found in such reports that energy targets could theoretically be met through "existing" or "current" technology.

On close examination, this claim appears to depend on a peculiarly disembodied sense of "existing" or "current". Jacobson and Delucchi (Table 1), for instance, take hydrogen technology for powering vehicles as a given ("We have assumed that most fossil-fuel transportation can be replaced by battery and fuel-cell vehicles"),[195] although even WWF acknowledges that "major challenges remain in storing and transporting" hydrogen fuel.[196] WWF, for its part, leaves out the fact that the supply infrastructure for its proposed scale-up of supposedly "existing" technologies such as wind, batteries and fuel cells does not in fact "exist" – unlike the infrastructure for "alternative" technologies that actually does exist, such as the Pgakenyaw shifting cultivation systems of Northern Thailand (Table 3), the windmills of western Denmark (Table 3), the *subak* irrigation system of Bali, or the dung-based cooking practices of parts of India – and would need to be built up and continually expanded at great cost to many human and non-human societies.

Many over-simple "matching exercises" also underestimate the challenge posed to alternative energy generation by industrial societies' just-in-time delivery systems, round-the-clock factory shifts and seven-day-a-week shopping regimes, which require huge storage capacity for the intermittently-produced energy from wind and solar generators, redundant systems to back it up, and expanded, ultra-centralized "supergrids" to divert it to distant locations at a moment's notice.[197] All of this – including the expanded battery capacity needed for storage – would require as-yet unbuilt infrastructure for exploring for raw materials across the globe, extracting, refining and shipping them to where they were needed, and repressing any resistance that arose as a result.

The assertion that an alternative energy system can be built around an "existing" technology that nevertheless lacks the physical, political and cultural infrastructure that would be needed to sustain it reflects a particularly virulent form of machine fetishism, since it obscures – and thus implicitly treats as unworthy of investigation – the political engineering and mechanisms of unequal exchange that would need to be built and defended in order to keep the relevant contraptions operating at the scale contemplated. To the extent that such assertions also disdain the question of whether the alternative technology is or could be embedded in powerful social movements, they become even more ungrounded. It is as if a government were to be advised to build its country's agriculture around seed-drilling machines that had no people to drive, build, deliver, maintain or fuel them and no prospect of being supported by any democratic or other political forces on the horizon.

To try to replace all of the energy that fossil fuels provide with renewable sources would require an impossible infrastructure.

Equally contentious are common assumptions about how easily and quickly the foreseen energy transition can take place. WWF again reveals its fondness for fetishism when it argues that "technology moves fast", citing the speed at which airplanes have come to play a dominant role in transportation and the internet in communications. But, as the historian of energy transitions Vaclav Smil points out, there is only one thing that all large-scale energy transitions have in common: "they are inherently protracted affairs" and "the more widespread the prevailing uses and conversions, the longer their substitutions will take".[198] California-based energy experts Mark Jacobson and Mark Delucchi acknowledge that their own plan would require "an effort comparable to the Apollo moon project",[199] but the problem is not simply the scale of the infrastructure that would need to be put in place – supergrids stretching around the globe, whole cities redesigned or rebuilt to improve on efficiency, the entire transportation fleet globally replaced. It lies also in the politics of the fuels that are being replaced. Oil and coal are commodities whose extraction, use and control are a matter of multiple political and economic infrastructures that extend far beyond the companies that mine or extract them. They are a part of the political regimes in the countries not only where they are extracted but also where they are used; they not only fuel cars and heat homes, but also shape labour relations, sustain military empires and build financial products such as oil futures.[200] It is their neglect of these entanglements that make fetishistic visions of smooth and rapid energy transitions so impractical as a guide to action

For experts such as Jacobson and Delucchi to reply that the engineering of infrastructure for their alternative machines will not be a problem,

since "the market" will take care of shortages, with higher prices spurring innovation and the hunt for new raw material deposits,[201] is merely to add a layer of price fetishism to the machine fetishism. Fantasies about the ability of price to cut through all the entanglements tying a particular set of machines to the rest of industrial society are no more likely to be fulfilled than was the theory, fashionable at the time, that the higher oil prices of the 1970s would lead to a green energy revolution. For anyone with knowledge of how little effect prices have had historically in bringing about structural social change, fetishism about price will appear as poor a guide to policymaking as fetishism about machines.

A more pragmatic response to crisis would work toward making distinctions such as that between little-e energies and big-E Energy more visible. Ted Trainer, one of the few environmentalists to have interrogated claims that renewables will be able to fuel "a society committed to affluence and growth for all", concludes: "Salvation cannot be achieved within consumer capitalist society – there must be changes from it to very different social, economic, geographical, political and cultural systems."[202] Echoing the demands of Southern-based movements such as the Latin America-based *buen vivir* movement, which is also explicit in its critique of the logic of capital, he argues for ways of living that ensure diverse energies for all, not Energy for accumulation through ever-expanding consumption and production.

Fourth Divide: Different Conceptions of Universality

The more closely the differences among the approaches to energy alternatives listed in Tables 1-3 are examined, the clearer it becomes that, despite the tables' titles, they are not reducible to differences in the location of points situated on a continuum between "global" and "local". Few of the "local" initiatives in Table 3, for instance, could reasonably be interpreted as implementations or "case studies" of the "global" proposals of Table 1. The move from the abstract, supposedly "global" preoccupations of, say, the academic specialists Robert Socolow and Stephen Pacala – or the "national" concerns of the Rocky Mountain Institute or UK government adviser David MacKay – to the differently-situated concerns visible in, say, the proposals of activists from Thailand's Prachuab Khiri Khan or the dialogue about "rights of nature" taking place in the Andes is in no way a move from universals to particulars, nor from big numbers to small ones.

But if the superficially more "local" proposals of the tables are not scaled-down versions of the allegedly "global" ones, neither should the "global" proposals be considered scaled-up versions of the "local" ones. The results of any attempt to distill out the "local" particularities of, say, the Thai or Ecuadorean initiatives of Table 3 to derive a residue that could be "replicated" universally, or serve as a basis for global policy, would either be so abstract that they were useless or so poisonous to economic orthodoxy and bureaucratic political process that they would quickly prove anathema to the World Bank, the World Wide Fund for Nature and most other developers of "global" or "national" schemes. The International Energy Agency would be unwise to expect any more support for its energy alternatives thinking from Transition Towns in Europe, say, than the Transition Towns can expect from the IEA for theirs. If some of the more complex and locally-grounded initiatives of Tables 2 and 3 refuse to be guided by, or even to accept the terms of, supply-demand "matching exercises", many of the latter, for their part, simply brush aside the wisdom expressed years ago by anthropologist Michael Thompson and colleagues: "the only frameworks that could tell you *anything* about the likely efficacy of a policy are those at the most local level."[203]

One revealing example of the shortcomings of the global-local schema in distinguishing different approaches to energy comes from the work of the US-based NGO EcoEquity and the Stockholm Environmental Institute. EcoEquity declares that livelihood, water and food security, as well as improved health care and education, can be provided for the world's poorest only through a "dramatic expansion of access to energy services". Yet despite its seeming egalitarian bias, this stance in favour of "global" justice and rights does not complement or support, but in fact actively works against, the conceptions of justice and of rights visible in

the initiatives of Table 3 that base defence of welfare and subsistence on opposition to extractivism, to expanded industrial energy infrastructure, and to the political processes that underpin them. The reason why was stated succinctly by social critic Ivan Illich more than 30 years ago: "So far, every single attempt to substitute a universal commodity for a vernacular value has led, not to equality, but to a hierarchical modernization of poverty."[204] "Energy services" can help small farmers with irrigation only if they have access to land and water in the first place and do not have to negotiate or fight with those who own them to ensure their survival. They can help people preserve food through refrigeration only if they have the food to refrigerate and a refrigerator to chill the food. They can extend the possibilities for formal schooling by providing lighting only where power bills, school fees and books are affordable. Equally, if "energy services" can help create jobs, they can also displace other jobs, particularly where machines replace manual labour, or lead to the increased exploitation of workers when artificial lighting extends working hours. The argument that an energy-expanded economy "lifts all boats" (a favourite metaphor of *laissez-faire* economists) is of comfort only to those who have boats in the first place.

Seemingly-egalitarian plans to provide "energy services for all" that do not consider the relations involved in energy production can end up in conflict with movements for equality.

Thus the livelihood plans formulated by residents of Thailand's Prachuab Khiri Khan are explicitly grounded in resistance to established Thai electricity politics – which, like most others, justifies itself by saying it is expanding "energy services" to meet "demand". In southern Africa, as David A. McDonald documents, while electricity restructuring programmes tend to generate "enormous 'goods' for a relative few," they wind up "perpetuating poverty, illness, social exclusion and environmental decay for many and serving as little more than a platform for economic growth for capital".[205] In Ecuador, one indigenous farmer from the region bordering the Colombian border drew a sobering lesson in a recent tri-national Peru-Ecuador-Colombia workshop on energy:

> "My community doesn't have electricity, but we don't want the state to install it, either. It would come only on the condition that other, non-beneficial projects were allowed, like oil exploitation, and we would need to spend a lot of our small income on bills, and with the electricity would come television and other trickery (*mañas*) that would affect our children. Finally, we don't need that kind of energy because in our community we already have energy, through cultivating our own food, curing ourselves with medicinal plants, and maintaining our customs."[206]

Such statements can be set alongside important declarations from recent and current Bolivian political leaders. In 2010, President Evo Morales drew a distinction upending the assumption that any "expansion of energy services" to the poor will unproblematically further the cause of justice: "We, the indigenous people, only want to live *well*, not *better*. Living better is to exploit, to plunder, and to rob, but living well is to live in brotherhood."[207] Along similar lines, Pablo Solon, the former climate spokesman for the Bolivian government, has criticized the way that the "right to development" has been used to "cover up . . . insatiable thirst for profits"[208] on the part of business and financial elites. The conception of justice or rights implicit in such statements differs from that of EcoEquity or the United Nations leadership not

in being less "global" in geographical scope, but in far more profound ways. The simplistic background assumption informing the work of many NGOs, as well as typical ruling elites, is that working toward energy justice is like dividing up pennies among small children. We give so many pennies to Petunia, so many to Ahmed, so many to Bao, and finally fairness is achieved. Perfect equality may not be possible, of course, but that is the ideal. If Petunia gets more, Bao must get more too. And if Petunia got more in the past, then Ahmed must get more in the present in compensation.

But when scarce thermodynamic work replaces pennies, and societies replace small children, so, too, do such simplistic notions of justice go by the board. Distributing energy on an industrial scale is not like distributing a jar of pennies. The practice of producing, transmitting and maintaining industrial energy is itself shot through with a dynamic of continually-growing inequalities. The abstract, capital-E Energy of the industrial era – monolithic, uniform, accumulable in vast quantities, and eternally scarce – is intrinsically opposed to entangled, concrete, lowercase vernacular "energies", as well as the right to live of humans and nonhumans alike.[209] As Ivan Illich emphasized some 30 years ago, the more deeply the notion of scarce Energy services becomes entrenched, the less space remains for such commons energies:

> "The idea that clean and abundant energy is a panacea for social ills, that equity and energy consumption can be indefinitely correlated under the right political conditions, ignores the distinction between commons and resources and the creation of scarcity."[210]

As anthropologist Alf Hornborg explains, energy-dependent industrial "technomass" – the source of EcoEquity's "energy services" – can be sustained only through a system of unequal transfers of energy, whether mediated by fossil fuels or any other source of Big-E Energy of similar magnitude:

> "[A]s we coax rural people in Brazil and Mozambique to devote their land and labour to support our technomass, the economists are seriously proposing that those rural people in the South are the ones who should be grateful – for the opportunity to 'develop'. Perhaps, at some point in the future, this will appear as absurd as it now would appear to us, if someone in sixteenth-century Peru had tried to persuade the peasants that one day, in the future, they would all have access to warehouses equal in size to those of the Inca emperor."[211]

This is not the familiar assertion – often made by racist Northern policy analysts eager to displace the problem of energy consumption to the global South – that the growing clamour for conventional energy in populous countries such as China must be curbed if it is not to result in the overstepping of the earth's "limits". It is, rather, the point that the "energy service provision" referred to by organizations such as EcoEquity and the Stockholm Environmental Institute has always contained within itself a profoundly inegalitarian and colonialist dynamic. If China is to be cited here, it should only be, to borrow the words of activist-scholar Dale Jiajun Wen, as a "microcosm of the world":

> "The rapid economic growth of the last 30 years has resulted in an alarming polarisation between rich and poor. China's 'Gini

> index', the commonly used measure of inequality, was below 30 in the 1980s – comparable to more egalitarian countries such as Norway and Sweden. It has climbed to around 45 today, more similar to the US or Latin American countries. The per capita GDP ratio of the richest and poorest provinces is more than 8:1, while the ratio between the US and China per capita GDP is 10.7:1 . . . [A]n energy expert once expressed his grave concern to me: 'No matter how much ecological space we still have, if we don't change the current growth model, the rich cities will use up most of it, leaving little space for the rural areas'."[212]

If there is no basis for assuming that the "global justice" of one energy alternative is a scaled-up version of the "local justice" of another, then neither is there much basis for saying that words such as "energy", "decentralization", "rights" or "enoughness" are used in compatible ways among energy alternatives advocates worldwide. The glib slogan "think globally, act locally" is not only blatantly false to the experience of the different sides in the energy alternatives debate: it is also dangerous to progressive energy politics insofar as it assumes that "the global" is only a magnified version of "the local" and posits a community of interests or a compatibility or comfortable "nesting" of political processes that does not exist.

The radical nature of the differences among different proposals for "energy alternatives" suggests that activists also need to approach what are called "inside/outside" strategies with caution. It has become a cliché among campaigners that common objectives can be best pursued if some groups work in the streets, organising mass protests, while colleagues follow a parallel course of lobbying in arenas inhabited by public and private financial institutions, UN agencies and so forth. And it is often true that grassroots work – say, to stop a large infrastructure project – is often helped by activists pushing a financial institution, say, to follow its own rules or a national government to obey its own laws; and vice versa. In fact, even movements aiming at the outright abolition of a damaging institution can occasionally be furthered by what might appear in the short term as efforts at mere "reform" pursued by insiders. Fifty years ago, German writer Andre Gorz identified what he called "nonreformist reforms" as worth pursuing because they create new spaces for contestation, empower popular movements, and identify and sharpen structural contradictions in ways that keep struggles for structural transformation alive.[213] Thus even the most reactionary of the alternative proposals of Tables 1-3 contains materials and methods that, recontextualized, may become useful to more radical initiatives in certain movement circumstances.

Some reforms create new spaces for democracy. Others do not.

Yet for those activists with long experience of supporting and intervening in official processes, it can often be all too comfortable to assume that, regardless of case and circumstance, there must *always* be something that can be done "inside" official or corporate processes to support those "outside". It may be tempting to think, for example, that the cause of groups struggling to keep fossil fuels in the ground or pollution out of the air will automatically be furthered, or at least not harmed, if environmental lobbyists see to it that enough text with words like "renewable energy", "efficiency", "equality", "environmental standards" and "community safeguards" makes its way into the documents of the World Bank, the Green Climate Fund or energy corporations.

Writing "community safeguards" into mainstream energy policies can wind up working against the interests of the communities concerned.

But, as grassroots groups have often pointed out to colleagues who frequent official meetings in capital cities, this is not the case. Depending on context, such actions can often instead strengthen the hand of fossil fuel industries and the national energy bureaucracies that support them, while weakening popular movement-building efforts by diverting resources into consultations that legitimize business as usual. Spoken inside a World Bank meeting room, phrases like "free prior informed consent" generally mean something radically different from what they mean spoken outside, and may, by creating new spaces in which it becomes permissible for private sector profit-takers to operate, throw a lifeline to corporate activities that grassroots groups want to eliminate. Similarly, what look like welcome "nonreformist reforms" sometimes turn out to be what Gorz termed "reformist reforms", which may be easier to justify to funders and mainstream politicians, but which demobilize or disempower popular movements, legitimising capital accumulation in return for gaining bogus markers of "success" such as promises of aid or decreased energy intensity.[214]

To put the point in another way, just as many popular movements interpret words like "energy", "energy savings", "justice" and "rights" in a radically different way than government ministries, so, too, do they have a different understanding of the concept of "universalising the issues" or "fitting the campaign into the global picture". For them, furthering the cause of energy alternatives at "higher" political levels is not necessarily a matter of getting laws passed with the words "energy alternatives" in them, or securing commitments from private banks to fund energy efficiency with ever more massive loans; indeed, it is as likely to be a matter of questioning such laws, commitments and institutions. On their view, pursuing the issues at a "higher" level is more likely to involve recognizing how centralization is always dependent on what economist Elinor Ostrom calls "polycentrism".[215] It is also likely to involve building what Slovenian thinker Slavoj Zizek calls "pacts of struggles" rooted partly in sharing, often through metaphors and stories rather than through categorization, the experiences of each culture and locality – including the outrages committed in the name of "energy alternatives".

This process can be clarified by two examples from energy politics. One example concerns what has been called the NIMBY phenomenon – named after the "not in my back yard" attitude of communities who object to the local siting of factories, mines, waste dumps and so forth. The standard critique of NIMBY is that it is an enemy to a universal or "global" approach to environmental problems. Local communities that object to wind or solar farms in their midst, for example, are often said to "lack the big picture" and to be "obstructing the larger energy transition". Sometimes they are even accused of a *sauve qui peut* attitude of indifference to the fate of similar communities elsewhere: after all, it is said, if a wind farm is not located in one community, it must surely be located in another.

NIMBY communities themselves are often astonished to find themselves characterized in this way. Many view their struggle as universal or "global" in the best sense, seeing themselves as fighting for the right of

all communities to refuse unreasonable demands and for principles of consent and procedures of respect that should be applicable everywhere. Far from refusing solidarity, many view themselves as contributing to a larger process of cooperative inquiry and incremental action aimed at challenging the premises of a system of technopolitics that disadvantages other communities as well as their own. Far from putting their problems off on other communities, they often work together with them so that projects that no one wants need not be situated anywhere. Like the Brazilian rubber tapper union activist Chico Mendes, they come to articulate in the course of their battles the understanding that they are not fighting for themselves alone, but for humanity in general, and that this "universality" is an essential, not an incidental, aspect of their struggles, without which it would have little sense.

A second example is a new verb that has recently entered the Spanish language: *yasunizar*. *Yasunizar* derives from Yasuni, the oil-bearing region of the Ecuadorean Amazon whose residents, aware of the disastrous effects of extraction elsewhere in the country, have long been fighting to keep its petroleum in the ground. Far from being a movement of simple refusal, the original Yasuni initiative encompasses a broader questioning of extractivism, a striving to strengthen community livelihoods, and a collective investigation of the possibilities for a post-petroleum civilization, and coordinates with efforts developing different approaches to energy such as the initiative for community self-rehabilitation described by Ecuador's Clinica Ambiental (Table 3). It also seeks international monies from industrialized countries as recognition of the value of its efforts for the earth and as compensation for accumulated ecological debt – and not as payments for "environmental service" commodities. *Yasunizar* signifies the spread of similar approaches to other regions and countries worldwide, in the sense neither of the application of a universal formula nor of a "scaling up" of the principle of keeping oil in the soil, but in the sense of an alliance of movements growing out of specific histories of resistance, working toward a post-fossil civilization, and continually discovering and developing what they are. In somewhat the same vein, labour activist and thinker Jonathan Neale (Table 2) writes of the UK's "million climate jobs" initiatve with which he is associated that while "we cannot halt climate change only by action in the UK," nevertheless, "if we act, people all over the world will know, and take hope and courage to act themselves."[216]

What counts as being a "global actor"? What counts as being a "local actor"? The questions are hotly contested.

An opposing conception of universality might well view the project of *yasunizar* (or of independent climate activism by trade unions) as a complement to, or component of, a global project of imposing or enforcing scientifically-administered "limits" on oil production and consumption. Or it might simply see *yasunizar* as a doomed, divisive project that, because it fails to recognize that a top-down plan for reducing global consumption must be realized before production is reduced, or that a technocratically-executed global "cap" on energy supplies must precede local efforts to exclude fossil fuel extraction, will tend merely to force oil companies to exploit other reserves to which it is even more difficult to gain access. Either formulation is at odds with the conception of universality expressed in *yasunizar*. To "yasuni-ize" is to engage creatively and autonomously in a complex of collective resistance and social construction and reweaving that cannot be reduced to an

application of scientific principles or concepts of global governance. Slovenian philosopher Slavoj Zizek points to the importance of this distinction when he suggests that the "key moment" of any political struggle is the "rise of universality out of the particular lifeworld":

> "The commonplace according to which we are all thoroughly grounded in a particular, contingent lifeworld, so that all universality is irreducibly coloured by and embedded in that lifeworld, needs to be turned around. The authentic moment of discovery, the breakthrough occurs when a properly universal dimension explodes from within a particular context and becomes 'for-itself', and is directly experienced as universal. This universality-for-itself is not simply external to or above its particular context: it is inscribed within it."[217]

This kind of universality appears, or "actualizes itself," Zizek stresses:

> " . . . as the experience of negativity, of the inadequacy-to-itself, of a particular identity . . . Within every particular culture, individuals do suffer, women do protest when forced to undergo clitoridectomy, and these protests against the parochial constraints of one's culture are formulated from the standpoint of universality . . . The formula of revolutionary solidarity is not 'let us tolerate our differences', it is not a pact of civilizations, but a pact of struggles which cut across civilizations, a pact between what, in each civilization, undermines its identity from within, fights against its oppressive kernel. What unites us is the same struggles. A better formula would thus be: in spite of our differences, we can identify the basic antagonism or antagonistic struggle in which we are both caught; so let us share our intolerance, and join forces in the same struggle. In other words, in the emancipatory struggle it is not the cultures in their identity which join hands, it is the repressed, the exploited and suffering, the 'parts of no-part' of every culture which come together in a shared struggle."[218]

What Might Make a More Fruitful Energy Alternatives Dialogue Possible?

This report has identified four key, overlapping points of difference or conflict in the debate over energy alternatives:

- Different energy alternatives proposals are based on different presuppositions and ask different questions.
- They hold sharply divergent conceptions regarding the embeddedness of energy in history and society.
- They give their allegiance to opposing political/technological processes.
- They rely on contrasting conceptions of universality.

The presence of these profound divides rules out any possibility of a harmonious "master synthesis" of the contents of Tables 1-3. They also cast severe doubt on the wisdom of trying to find peace among the proposals by just trying to "mix and match" elements from each one. Indeed, the tensions among certain initiatives are so fundamental that an attempt to translate even certain single words from one proposal into their homonyms in another is likely to stir resistance. Communities in India or Ecuador damaged by extractive activities, for instance, are unlikely to hear the words "rights" or "justice" as used by the United Nations as legitimate interpretations of the "rights" and "justice" that come out of their own mouths. The villagers of Prachuab Khiri Khan province in Thailand might not accept Robert Socolow and Stephen Pacala's "technology", for example, as a translation of any word in their own vocabulary. Amory Lovins's Rocky Mountain Institute is unlikely to accept rural commoners' term "enough" in translations of its own discourse on enoughness. Most importantly, many communities implicitly reject the translation of their own word "energy" into the "energy" of technocrats or government ministers.

This antagonism flares up perhaps most noticeably when grassroots movements opposing mainstream energy projects such as tar sands developments, nuclear power plants or large hydroelectric dams are faced – as they so often are – with the peremptory, bullying demand, "What's your alternative?" The demand is often experienced as a booby-trap insofar as it assumes that the movements must be interested in provision of exactly the same big-E "Energy" that they are – uniform, scarce, infinitely accumulable – and thus obliged to produce an alternative proposal for supplying it. Movements that favour different "energies" resent being held to an "obligation" whose terms they have never accepted and whose fulfillment would signify a betrayal of their own

commitments. Yet if they repulse the "obligation", they are excluded from energy discussions because they are seen as "talking about something else". And their attempts to be heard may ultimately culminate in inarticulateness because they do not know where to begin to explain the difference between the questioners' "energy" and their own.

Thus few activists who criticize the role fossil fuels play in industrial societies – the way they increase inequality and scarcity, for example, or help create unsustainable demand for vast quantities of abstract thermodynamic work – will be eager for an "alternative" to fossil fuels that plays the same role. Few who question the top-down technopolitical processes associated with standard energy planning will want to propose "alternatives" that also presume to represent the interests of society as a whole. Few with appreciative, hands-on experience of flourishing, low-carbon subsistence energy practices of the kind followed by thousands of rural communities worldwide will assume that they need to be replaced by other "alternatives" just because they might not respond satisfactorily to the productivity crises of elites. Such critics are more likely to respond to the demand for "alternatives" by problematising the question, challenging its hidden, disabling assumptions, and embedding it in a political process of inquiry in which, for example, the question "What technologies can supply needed energy?" cannot be addressed without addressing the questions "What is energy and what is it for?", "Who needs it for what?", "How do different classes defend their interests in different kinds of energy?", and so forth. They are well aware that, as Zizek puts it, the aggressive, dismissive demand "what's your alternative?":

The question "What's your alternative?" must itself be questioned.

> ". . . aims precisely at precluding the true answer – its point is: 'Say it in my terms or shut up!' In this way, the process of translating an inchoate protest into a concrete project is blocked."[219]

By the same token, while there remains a strong temptation among some environmentalists in the global North to surrender to the slogan that "the climate situation is so serious that we have to stop criticizing and take action now – any action!", the temptation needs to be resisted. If different types of "action" to promote energy alternatives conflict with and undermine each other as deeply as this report has suggested, then it follows that many types of "action" will be counterproductive. An undiscriminating call for "action now – any action!" will inevitably become a pretext for the most reactionary forces on the global stage to launch yet further, highly-profitable assaults on the global environment.

Indeed, problematizing the bullying question "But what's your alternative?" is actually an essential starting point for the kind of action that the climate and energy crises demand: alliance-building that recognizes and respects, rather than tries to paper over, the deep divides reflected in Tables 1-3. That may entail trying to understand better some of the strategies that block exploration of these divides.

Overcoming Blocks to Dialogue

Three manoeuvres that are often used today to stymie fruitful discussion about energy alternatives stand out in particular:

(1) "You are talking about the same thing I am talking about. We mean exactly the same thing by 'energy' ('technology', 'justice', 'neutrality', 'alternative', and so forth). But you've got your facts wrong. So get them right and then maybe we can work together."

(2) "You don't seem to be talking about the same thing I'm talking about when we talk about 'energy' ('technology', 'justice', 'neutrality', 'alternative', and so forth). Define your terms! If we agree on a definition, then we can decide who is right and who is wrong by appeal to facts or values. If we don't, then you have to go to a different room and have a different discussion."

(3) "What I mean by 'energy' ('technology', 'justice', 'neutrality', 'alternative', and so on) simply can't be translated into your language. We're using different conceptual schemes. We can't negotiate, argue or even talk about these things."

All three manoeuvres stifle efforts to formulate and take action toward a reasonable energy future.

For example, state energy bureaucracies are accustomed to being able to sidestep dialogue simply by assuming that indigenous or peasant thinkers mean the same thing by "energy" that they do. Not only does this assumption save time; it also makes it easy to meet community challenges to energy extraction policies with the booby-trapped put-down "If you want energy, what's your alternative?" As a bonus, it makes many indigenous or peasant beliefs about energy look strange. How many state bureaucracies, North or South, can be forced to pay attention to long disquisitions about – to take one example – the relationships, interactions and flows that produce and sustain life; the impossibility of separating out energy, which is entangled in relationships, in order to sell and control it; or the global disequilibrium and fragmentation of the unity of *pachamama* (the Andean "mother world" divinity) that comes with oil extraction?[220] To an urban middle-class loyal to the concept of the uniform, accumulable capital-E "Energy" that arose in conjunction with the rise of fossil fuels during the Industrial Revolution, what many indigenous or rural groups say about energy will seem at first sight to be either romantic or beside the point.

Energy bureaucracies often sidestep dialogue by assuming that ordinary people mean the same thing by "energy" that they do.

Yet if to avoid being "exoticized" in this way, the communities in question fall back to the position of saying that they don't have the word "energy" in their languages, or that they do, but define it differently, then the field is left pretty much to the bureaucrats. And for either side to claim that the bureaucratic and indigenous languages "can't be translated into each other" is to concede defeat for the project of dialogue and alliance-building altogether – an outcome that is usually, again, extremely convenient for energy bureaucrats who would prefer as little critical discussion as possible, particularly of their own assumptions.

Countering these three dialogue-blocking manoeuvres is difficult. One classic response on the part of indigenous and rural peoples and others has been simply to invite bureaucrats, politicians or corporate executives into their communities to experience for themselves, as guests, what a different "energy" or a different "technology" might look like in practice. In an extreme form of this gambit, they are taken prisoner for a short or even a long time.

Dissident urban-based intellectuals, meanwhile, have pursued their own strategies. Raymond Williams and Ivan Illich, for example, spent much of their lives trying, often unsuccessfully, to communicate their sense that differences such as those examined in this report even existed and could be clearly identified. In arguing that a space had to be kept open for public debate that could respect such differences, they told stories from history, sociology, anthropology, linguistics and literature, as well as from their own experiences in the doorways and passageways between peasant and bureaucrat, countryside and city, and one generation and another. Williams, a literary scholar from a working-class background, battled to show that in studying concepts such as "work", "technology" and "energy", it was useless to try to ignore the way that, while they "seem to have been there for centuries, with continuous general meanings," they "have come in fact to express radically different or radically variable, yet sometimes hardly noticed meanings and implications of meaning".[221]

Illich, a polyglot polymath and roving activist refugee from the Catholic priesthood, struggled to convince his readers that there was a thoroughgoing opposition, and not a congruence, between, for instance, commons and resources; between unpaid subsistence activities and unpaid work in the service of industrial societies; between the "mechanical sciences" of medieval thinker Hugh of St. Victor and the "technology" of the International Energy Agency; between language as vernacular activity controlled by people for their own purposes and "officially taught mother tongue" suited to a commodity-intensive society; between "a mile moved on my own" and a passenger-mile; between public space and a commons that is "neither wilderness nor home" but "that part of the environment for which customary law exacts specific forms of community respect"; and between the "energy" of the theory that decides what the physicist sees and the "energy" that "refers to a subtle something that has the ability to make nature do work" and is "something that individuals and societies need".[222]

How to build encounters or dialogues that can respect radically-different conceptions of energy? The question is often a matter of life and death.

Such attempts to maintain active dialogues about difference, however difficult, are bound to continue, if only because respecting the differences in question is so often a matter of life and death. But help is always needed in challenging not only the three dialogue-blocking manoeuvres listed above, but also, more fundamentally, the false cliché underpinning them all: that there are foolproof ways of distinguishing questions about meaning from questions about belief, questions about translation from questions about truth, questions about language from questions about fact, theory or value, questions about mind from questions about world, questions about "conceptual framework" from questions about "empirical content", questions about power from questions about truth. Once that assumption begins to lose its hold, so does the temptation to think that the fundamental differences regarding energy that this report has outlined can be resolved just by appealing to "facts", "values" or definitions of terms.

Thus it may be helpful to carry Williams' and Illich's project forward by enlisting two figures who confronted language/fact and meaning/belief dichotomies more directly than they did and, in doing so, added a great deal of bite and reach to the analysis of the kind of political conflict

that rages today over energy alternatives. Through a series of extended arguments, examples and narratives painstakingly developed over five decades, W. v. O. Quine and Donald Davidson, two of the most respected analytic philosophers of the last half of the 20th century, working in parallel with colleagues in fields such as the history and sociology of science, pioneered fresh ways of undermining the three strategies' pretence of being able to elucidate or rationally resolve complex debates.[223]

Quine began by considering the pragmatic predicament of field linguists trying to make sense of the utterances of a person speaking a language of which they know nothing. Such labourers at the coal face of interpretation do not have the luxury of access to a fixed "meaning" in the heads of their subjects that they can then use to work out what they believe. Faced with the "problem of abstracting simultaneously the roles of belief and meaning from the pattern of sentences to which a speaker subscribes over time",[224] as Davidson put it, they instead have to "play off awkward translations against ascriptions of quaint beliefs, and vice versa".[225]

Such linguists might be confronted, for example, with a choice between, on the one hand, interpretations that assume that the English word "energy" must translate an equally short expression in, say, the Andean Kichwa language (thereby making Kichwa beliefs seem weird); and, on the other, translations that assume that Kichwa beliefs must be reasonable and are willing to forego one-word dictionary definitions of Kichwa terms in favour of encyclopedia entries with long footnotes. Which one they choose at any particular moment cannot be determined by their inspection of some "Kichwa conceptual scheme" fixed in the heads of their subjects – something to which no one, including the Kichwa themselves, has access. Instead, their choice depends on practical or political factors: who the audience for their translations is; the extent to which they have to take account of Kichwa resistance to the translations they ultimately propose; how much time they are willing or able to devote to observing how their Kichwa-speaking contacts react to other sentences; how convenient it is, overall, to opt for one translation rather than another; and so forth.[226] The activity of translation may provisionally come to rest, gradually or quickly, at one point or another, depending on circumstance, but is never complete or "correct" in any stronger sense.

Do our interlocutors have odd beliefs about energy? Or do they just use the word in odd ways? There will not always be one clear answer.

In essence, the field linguist's predicament is everybody's. It arises whenever anyone says something puzzling, even in the same language. When, in a movie from the 1930s, comic actor Stan Laurel tells a ship captain that he doesn't like the sea because it is infatuated with sharks, is he making a factual mistake about the ocean, displaying signs of mental illness, or just accidentally or deliberately misusing a word? It depends on the circumstances and his listeners' knowledge of the other things he says and their decisions about how to treat him. In such everyday circumstances, interpretation is no big problem. However complex the process may be, almost everybody in his audience instantly converges on the conclusion that Laurel is pretending that his character thinks "infatuated" means "infested", not expressing the belief that the ocean has feelings. Judgement might conceivably be suspended pending further information, but it rests there because the audience decides to treat Laurel with a certain respect.

Field linguists' choices may not be so self-evident, but they are by and large equally uncontroversial. Most linguists would not even consider the hypothesis that the alien utterance "gavagai", uttered in the presence of rabbits, means not "rabbit" but rather "rabbit-part" or "let's go hunting" – even if such translations were equally good at predicting behaviour when combined systematically with similarly odd translations of other terms. In practice, field linguists do not usually risk much resistance if they follow the rule of thumb that "an enduring and relatively homogeneous object, moving as a whole against a contrasting background, is a likely reference for a short expression" in an alien language.[227]

But the job of translation does not always end so happily or quickly. In his dystopian novel *1984*, George Orwell raised the hypothetical question of how the 1776 US Declaration of Independence would be translated into Newspeak, the language invented by his fictional totalitarian state. He concluded that a translation based on the principle that the framers of the Declaration and speakers of Newspeak meant the same thing by words such as "liberty" would picture the framers as holding beliefs that were not just quaint, but criminal ("crimethink"). An alternative, equally "correct" translation that focused on treating the framers more "charitably" and letting the meaning of words like "liberty" fall out where it might would, on the other hand, interpret the Declaration as a "panegyric on absolute government." Neither translation would have been satisfactory for the framers themselves, who, had they been present in Orwell's fictional world with enough power, would presumably have used whatever means necessary to force the translation process to continue until a more congenial result was achieved – even if that meant adding so many awkward footnotes to the translation that years of "re-education" or "unlearning" were required.[228]

The process of translation does not always end in a way that satisfies both sides.

Power and Translation on the Ground

The example from *1984* is not extreme. In 2008, a powerful Ecuadorian movement fuelled partly by indigenous reaction to a neoliberal era of exploitation of oil, privatisation, indebtedness, and lack of social investment opened space for the drafting of a new national Constitution that broke entirely with global tradition. The new constitution formally recognized an interlinked complex of three concepts drawn from indigenous commons practices that have historically been at odds with capital accumulation and with Cartesian or Malthusian conceptions of nature as scarce resource:

- *Buen vivir* or plural types of good living, as opposed to a single, quantifiable, endlessly "better" living achievable only through exploitation of others and of nature.

- Nature as a subject of rights, as opposed to a passive collection of raw materials or "resources" separated from humanity.

- Plurinationality as a practice of radical, deliberative, intercultural democracy necessary for the pursuit of a plural *buen vivir* in which the rights of no minorities are breached, as opposed to a centralized democracy premised on uniform state procedures of

formal "participation" and equitable citizen access to the fruits of capital accumulation, in which minority rights may be breached for the sake of an aggregated, quantifiable "general interest".[229]

At least in abstract terms, the new Constitution recognized the tensions between a commons conception of living territory and a notion of land as a fragmentable commodity; between dialogue with nonhumans and the objectification of nature; between a commons conception of "enoughness" and quantifiable "development" on a capitalist model; and between a political process promoting dialogue and mutual intertranslation among adherents of different types of justice and rights rather than their subsumption, through one-way translation, into single, standardized state-approved varieties. If there was ever an integrated "energy alternative" proposal deserving of the name, it is the one toward which the new Ecuadorian Constitution gestures, using these concepts.

Predictably, however, the state quickly began to translate the three concepts above into conventional industrial terms, thereby attempting to erase the distinctions the new Constitution had just recognized, together with the "energy alternative" they had implied. For example, in March 2010 the Constitutional Court ruled on a lawsuit that the Confederation of Ecuadorian Indigenous Nationalities (CONAIE) and the Communitarian Water Systems of Azuay (CWSA) had brought against a new mining law approved the preceding year, which had greatly expanded the scope for open-pit mining in indigenous territories. CONAIE and CWSA had argued that the law was unconstitutional in that it violated, among other things, the right to prior consultation, the right to territory, and the rights of nature and water. The Constitutional Court majority was able to reject these arguments by translating each of the three concepts above into an industrial language that turned the indigenous position into either "crimethink" or an endorsement of the developmentalist, extractivist perspective that the new law represented.[230]

In Ecuador, a recent legal struggle over mining and energy was largely a struggle over how words such as "nature" and "plurinationality" were to be translated.

First, the Court majority opinion interpreted Article 57.17 of the new Constitution, which requires that affected groups "be consulted before the adoption of a legislative measure that could affect any of their collective rights [*derechos colectivos*]", as without significance except insofar as it could be made consistent with the "principle of equality" of all groups "before the law" and that of "putting the general interest over the particular". Any "collective rights" whose recognition might contradict the assumption that all interests are economic and capable of being averaged were interpreted as threats to justice and to the state. Translated into the language of industrial capital, Article 57.17 suddenly appeared exclusionary insofar as it gave "unfair advantage" to certain indigenous groups who put their interests above the "general interest". Moreover, by reinterpreting *buen vivir* or "good living" as "general interest" defined in economic terms, the Court majority was able to argue that the plaintiffs themselves were taking a stance against the *buen vivir* clauses of the Constitution. All this set the stage for further conflict. The interpretation of collective rights as economic, when translated back into the language of the indigenous plaintiffs, itself appeared exclusionary insofar as it did not allow for participation on their

terms. The interpretation of *buen vivir* as being a matter of consumption, social investment and state services, meanwhile, flew in the face of the plaintiffs' understanding of the term.

Second, the Court majority took exception to CONAIE's claim that the new mining law was in breach of the constitutionally-guaranteed right to territory insofar as it allowed displacement, division and taxation of indigenous lands, thus treating their territory as exchangeable, replaceable, fragmentable, susceptible to economic valuation, and detachable from its inhabitants. According to the Court's majority opinion, "right to territory" could only mean private property right; the only way of removing land from the realm of private contract would be to make it into a protected area under conservation laws. On this interpretation, the demand that some lands outside protected areas be treated as non-exchangeable amounted to an unjust denial of the rights of nonresidents to use or acquire it for commercial benefit.

The Ecuadorian court's interpretation of* buen vivir *as being a matter of economic development is a fighting matter for indigenous groups.

By the same token, the Court majority dismissed the CWSA's view that the new mining law was "disrespectful" of and "aggressive" toward water and its rights, and thus in breach of constitutional protections for nature as a subject. For anyone versed in law rather than merely local feelings about communitarian water systems, the Court majority reasoned, treating nature as subject was consistent with exploiting nature using "all the environmental controls possible", as provided for in the mining law. Again, this interpretation was crucial if the constitutional right of Ecuadorians to good living – provided, in part, through the benefits flowing from mining – was to be assured. Translated back into the language of the indigenous plaintiffs, of course, the Court's opinion itself amounted to an unjust denial of constitutional rights: the right to treat certain lands as non-commodifiable, the right of nature not to be treated as object for exploitation, and the right to a type of living that did not rely on treating other humans and nature as objects.

Third, the Court majority reinterpreted "plurinationality"as equitable access to the economic benefits of mineral extraction, reducing what the plaintiffs saw as a particular kind of democratic political process to an economic formula according to which differences among various groups' approaches to life and livelihood were unimportant or nonexistent. In this, it echoed the views of President Rafael Correa, for whom plurinationality is nothing more than an issue of maintaining ethnic "identities" while continuing extraction:

> "Enough of childish ideas of saying no to oil or mining . . . The challenge is to live well without losing one's identity, but keeping one's identity does not mean continuing to be miserable . . . We cannot be like beggars sitting on a bag of gold . . . the worst racism is to pretend misery to be a part of one's culture."[231]

This translation of "plurinationality" is a fighting matter for many indigenous groups. As Humberto Cholango, the president of CONAIE, explains:

> "It is not possible to breach our rights and rights of nature . . . We don't think that Ecuador can develop as a country if to accomplish

some rights it is necessary to breach others. We cannot negotiate our principle of plurinationality, which is not a conflict between indigenous peoples and government, but is a conflict as society."[232]

One of additions to this picture provided by philosopher Donald Davidson was to observe that at no point can any sense be made of the proposal to call a halt to such processes on the ground that the two sides have "different conceptual schemes" or "carve up the world" in mutually untranslatable ways. "What makes interpretation possible is the fact that we can dismiss *a priori* the chance of massive error," he argued. "We could not be in a position to judge that others had concepts or beliefs radically different from our own . . . Disagreement and agreement alike are intelligible only against a background of massive agreement."[233] Difficult as they are, struggles over interpretation – and where it ends – have to be faced, not evaded.

Overcoming Cognitive Marginalisation

Such examples throw into sharp relief the political nature of even uncontroversial translations. Far from being prior to the rough and tumble of the process of interpretation, what counts as the meaning even of a single term at any particular time is determined by it, with the choice of what beliefs and values to attribute to others correspondingly also shaped by power relations. Defining words and ascertaining facts and

Translation Politics

What philosopher W. v. O. Quine called the "indeterminacy of translation" becomes most audible to the naked ear in cases of interpretation between unrelated languages. Every interpreter from Nuosu to English, or from German to Hopi, will recognize the frustration of being forced to "take sides" with one or the other party at every moment, caught between the rock of convenient one-word translations that make interpretees' whole societies look misguided or silly and the hard place of lengthy glosses that leave no time to get across main points.

This "slack" in translation is a political space, used and moulded by popular movements and the state alike in ways that shape the credibility of the different parties. What Yale University political scientist James C. Scott calls the "simplifying state", intolerant of anything that might break up its tables and checklists, is institutionally committed to matching brief, common phrases in vernacular tongues with brief, common phrases in economic jargon or its own bureaucratese. If the overall result militates in favour of the view that its citizens are backward or crazy, or have "no alternatives to propose", that is a small price to pay for administrative convenience.

Indeed, it is likely to be a benefit to the larger project of state-building. Thus when confronted with the spectacle of neat rows of rubber trees replacing messy-looking rattan gardens in East Kalimantan, Indonesian state functionaries are, so to speak, contractually obliged to think "development" and dismiss hostile local reactions as ignorance, stupidity or obstructionism.

Activists committed to postulating a community of shared purpose between themselves and their allies will make a greater effort to maximize a congruence of common sense across the language divide, even if it means going to the trouble of formulating longer and more awkward, allusive or metaphorical translations. They are free to read the same rubber plantations, more complexly and figuratively, as having the function of "emptying, without permission or advance warning, the bank accounts containing the life savings of the local rattan farmers".[234]

values is no foundation either for efforts at achieving mutual understanding and good relations among communities or for other political or scientific activities. Rather, it is a subset of them. And like them, it is essentially an endless, contextual enterprise. When bureaucrats or NGOs interpret energy justice as fair distribution of lumps of big-E Energy, they can expect opposition from communities insisting on a conflicting meaning of justice. If they concede that under some interpretations of "justice", the further development of big-E Energy itself, with all its exploitative dynamics, is unjust, but draw the conclusion that the alternative is an "unchanging traditional culture", they can count on deep resistance to that interpretation, too. Similarly, when economists attribute a community's resistance to the translation of its decision-making processes into the weighing of costs and benefits to "ignorance of economics" or "misinterpretation of its own values", they are themselves resisting translations that would put (say) activities such as subsistence outside a cost-benefit calculus.

Disadvantaged groups are often unable to press for translations that would advance their interests or rights.

Which meanings prevail at any particular point depends largely on familiar manifestations of power such as the ability to mobilize resources and people, to divide the opposition, to take advantage of traditions of racism, colonialism and patriarchy, and so forth. In zones of what British philosopher Miranda Fricker calls "unequal hermeneutical participation", disadvantaged groups are "hermeneutically marginalized" – unable to press for interpretations or translations that would best nurture and defend their livelihoods and evolving interests, and whose recognition in the public arena would also enrich the "collective understanding".[235]

Fricker cites an example from womens' struggles in the US in the early 1970s, when the dominant interpretation of the ubiquitous phenomenon of powerful men inappropriately touching women colleagues in the workplace was that it was a form of "flirting". Increasingly, women perceived that their own explanations of the problem in the prevailing language were either too weak ("I am being made uncomfortable by your persistent flirtation") or so crude that they trapped women in the cul-de-sac of being seen as "lacking a sense of humour" or "hysterical". What Fricker calls "runaway credibility deflation" often made things even worse, when the "implausibility of what [was] said create[d] a lens through which the personal credibility of the speaker" could be questioned, which in turn created a lens that made the existence of the experience being described look even less plausible, and so on.[236] Like Ivan Illich trying to express in contemporary English the difference between commons and resources, or between commoning and "natural resource management", women were typically put in the double bind of being seen either as "fiends" or as "impossibly vain". Yet at the same time, they were unable to insist on, or even to formulate, a detailed alternative interpretation to that of "flirtation". It was often difficult to render their oppression intelligible even to themselves, much less to share analysis of it in public spaces or find effective ways to stop it.

Only when women began to meet in groups to discuss the issue among themselves on what political scientist James C. Scott calls "protected sites"[237] could the interaction of numbers with storytelling skill, context, purpose, inventiveness and sheer stubbornness begin to provide a counterweight to the power dynamics of the dominant

process of interpretation. One day, a group of eight women planning a "speak-out" on the emerging, still-undefined issue in upstate New York suddenly hit on the felicitous phrase "sexual harrassment". Women were subsequently able to organize politically and legally nationwide around these words in a way that allowed the alternative interpretation to become, if not dominant, at least widely recognized in law and popular consciousness, as well as a significant addition to the cognitive endowment of the whole society. They had succeeded in bringing about what political psychologist Ashis Nandy calls the kind of progress most worth cherishing: "growth in the awareness of oppression".

The situation of countless groups and communities in debates over energy alternatives is similar. They commonly suffer an "acute cognitive disadvantage from a gap in the collective hermeneutical resource" used by dominant groups to structure talk in public spaces.[238] As a result, they are "rendered unable to make communicatively intelligible something which it is particularly in [their] interest to be able to render intelligible". Indigenous or peasant communities, for example, may well have terms that they feel to be equal to what they mean when speaking among themselves about "energy", yet risk loss of credibility in a public space whose politics of translation militates against them. This will be the case whether they are indigenous groups fighting to make it understood that their conceptions of "energy" diverge from that of governments and private corporations; commoners nursing an inchoate sense that there are alternative small-e "energies" that are incompatible with the big-E Energy around which most "alternatives" discussions revolve; objectors to Kyoto Protocol Clean Development Mechanism projects who find no space in questionnaires or consent forms for their sense that carbon trading is an unfruitful source of finance; resisters to cost-benefit analyses of proposed power plants who are unable to express their inchoate opposition except through assigning "infinite value" to an unpolluted environment; or even well-off historians struggling to make it understood that a 12th-century grain mill was not an "energy user" nor a 12th-century peasant a person with an "occupation". The more experience they have with this "hermeneutical injustice" (as Fricker calls it), the more that they are likely to view the notion – common among mainstream NGOs who have inherited the belief that languages are interchangeable screens that come between humans and an undistorted external reality – that vernacular or indigenous "energies", if they are to be given their due, can and must be translated into the language of capital under the conditions of translation politics in force in public spaces, as just another move in a strategy of oppression.

Being unable to make your interests intelligible in public space can be a kind of injustice.

Attempts to overcome this marginalization can benefit from greater consciousness that the charges of "misunderstanding" and "misinterpretation" that ricochet around all interesting arguments are at bottom negotiating moves in a power struggle, not claims capable of being settled once and for all by a neutral principle or authority sitting high above the fray. Political organization may not always be possible; but where it is, dominant interpretations can be challenged. Attempts by antidemocratic institutions and others to use the three manoeuvres listed above, and others, to lock meanings, facts and values into particular politically-advantageous configurations are, ultimately, quixotic. If interpretation is political, politics itself, reciprocally, consists largely

in continuous re-interpretation. Critic John Berger wrote recently about the "multitudes" on the wrong side of the wall dividing the haves from the have-nots that they:

> "have answers to questions which have not yet been posed, and they have the capacity to outlive the walls. The questions are not yet asked because to do so requires words and concepts which ring true, and those currently being used to name events have been rendered meaningless: Democracy, Liberty, Productivity, etc. With new concepts the questions will soon be posed, for history involves precisely such a process of questioning."[239]

Science without Mysticism

If field linguists are not channellers of occult "meanings in the head", but call on complex networks of relationships with human and nonhuman beings in sorting out the roles of meaning, belief and value, then neither can scientists be channellers of "nature" or "the real" or "the facts" in any sense more robust than that in which they are yet another group of inquirers engaged in the hard graft of using and establishing such relationships.

Many intellectuals in industrial societies have come to believe otherwise, often claiming that science's "success in coping with the world", its effectiveness and objectivity, must be due to the fact that, unlike, say, gardening or literary criticism, it is in touch with a metaphysical Other. The claim starts to fall apart, however, as soon as "coping with the world" is taken to mean anything more than "maintaining industrial society". The idea that scientists enjoy exclusive access to a mystical pipeline to the infinite then starts to look more like mere fetishistic fallout from the fact that industrial society happens to be dominant in the current historical era. From a perspective more detached from industrial concerns, the success of science – such as it is – is no more remarkable than the success of many other local forms of politics and culture, and as such requires no transcendental explanation. After all, as anthropologist Alf Hornborg points out, contemporary Europeans see no need to cite the Inca emperor's sacrifices and ritual communication with his father the Sun in order to account for the undoubted success of early 16th-century Andean corn harvests, whatever the emperor himself may have claimed.[240]

One moral of the stories that Quine and Davidson have told is thus that there is little point in advocating "science-based policy" without also acknowledging that science is policy-based and critically analyzing that policy; nor in repeating the fatuous pop slogan "knowledge is power" without also acknowledging that power is constitutive of knowledge and critically analysing the different kinds of power involved in particular knowledges.[241] Just as the question for environmental policy is not "What actions are in accord with the dictates of unchanging Nature?" or "What 'tune' is being called by chemistry, physics and climate science?", but rather "Given what we know, including what we know from chemistry, physics and climate science, what kind of relations with other human and nonhuman communities should our movements choose to mobilize around, inevitably contributing to changing those communities in the process?", so, too, questions about what a community means, believes or values about an issue like that of energy alternatives is inextricably

tied up with decisions about what relations to have with that community. If translation is politics, good translation (that is to say, good judgement about the theories, values and factual beliefs held by others) demands good politics. Portuguese activist sociologist Boaventura de Sousa Santos puts it this way in a 2005 discussion of the future of the World Social Forum:

> "Translation is not a mere technique. Even its obvious technical components and the way in which they are applied in the course of the translation process must be the object of democratic deliberation. Translation is a dialogical and political work . . . global social justice is not possible without global cognitive justice."[242]

The Persistence of Hermeneutical Injustice

In mid-January 2013, activists gathered in the centre of London for a meeting on "Ending the Oil Age". The discussions were framed, in part, by two presentations. One, by a British-based representative of a large international environmental organization, explained the way large oil companies saw current oil politics. It noted a trend toward a return to a situation of plentiful supply and lower-than-expected demand, with environmental considerations becoming less important relative to the logic of dividends, as oil companies more or less frankly planned for the "end of the world". A second presentation, by an activist from Canada involved in the struggles over Alberta's tar sands, stressed that effective alliance-building hinged on prospective partners beginning their journey together by talking about, and agreeing to acknowledge the centrality of, struggles against racism, oppression and colonialism. No one should imagine that such struggles had somehow to be resolved before undertaking environmental work, the presenter argued, but they did have to be confronted as they emerged within it, or alliances would crumble. Questions of environment, as indigenous movements had demonstrated, were not the preserve of European elites bent on maintaining a mythology of a "nature" uncontaminated by humans. They were questions of human rights.

It was hard not to see the two presentations as complementary. The first made plain how oil companies, as a matter of course, translated processes of colonialism, racial oppression and global destruction into means of coping with "resource scarcity". The second offered a perspective from which the colonialist, racist and oppressive nature of the supply/demand dynamics of oil development could be recognized in a way that could make environmental movements more effective.

Yet the two presentations' synergy was lost on the meeting's moderator, who summed them up by saying that while the first presentation had been "about the head", the second was "about the heart". The very fact that this remark was delivered casually and without any intent to devalue demonstrated the continuing hegemony of the subtly discriminatory divide that underlies most energy alternatives discussions, according to which scarcity, supply, demand and technology are tough analytical issues for brainy people to talk about in support of more emotional (though admittedly politically effective) characters who tend to get

obsessed with squishier questions of colonialism, racism and oppression. Presumably without making a conscious decision to do so, the moderator was effectively taking the side of mainstream development institutions that would prefer to dismiss (for example) the Clinica Ambiental or Prachuab Khiri Khan initiatives of Table 3 as "not talking about energy

Epistemology, Unbound Series . . .

The history of the modern attempt to erect a wall between "language" and "fact" – and its power to stall and forestall important discussions – is closely tied up with the attempts to set apart science from non-science (politics, religion, art and so forth) and elevate the one over the other that have occupied leading European intellectuals at least since the 18th century, and continue to be the obsession of bureaucrats and experts the world over.

Sometimes these efforts have gone under the fancy name of "epistemology." More commonly, they manifest themselves in homelier slogans that are relentlessly sprayed into the public arena by politicians, pundits, professors and technocrats across the globe – "our policy must be fact-based", "knowledge is power", "we must prevent politics from distorting science", "we must speak truth to power", and so on.

The underlying idea is that science is different from "softer" subjects not just because it helps make different kinds of things possible (mass production of internal combustion engines, say, as opposed to swidden agriculture or the writing of plays) but also because it makes "'objective reference' to things 'out there'" and is in "contact with the real."[243] On this view, the job of scientists – and those who aspire to their status – is to transcribe into useful public form what were hitherto nature's occult craft secrets. A benign glow gets cast over the campaigns and manipulations of experimenters toward the creation of controlled environments where results can be replicated and industrially reproduced. If non-human beings are probed or rearranged in these strange rendition sites, it is only because they have important hidden truths to reveal.

Scientists' supposed ability to channel a "nature" sharply set off from "society", moreover, is taken to explain the supposed "success" of industrial civilization and the imagined "failure" of all others – and in particular to explain the magical powers of wealth-generation that machines are seen to acquire when the unequal exchanges of useful energy that sustain them are obscured.

Integral to technology fetishism, in other words, is science fetishism. Both interfere with rational debate about energy alternatives.

Obviously, the political context in which science fetishism came of age is relevant. Swedish anthropologist Alf Hornborg suggests that the type of economics that dominates policy discussions in Europe today got its start in intellectuals' attempts to account for the "financial success of bankers and stockbrokers in the hub of the British colonial empire during the early decades of industrialism."[244] Naturally, the result favoured concepts like equal exchange, scarcity and comparative advantage over notions like unequal exchange and exploitation, which were not mentioned. So, too, epistemology was arguably in part a cover story explaining and furthering the growing dominance of European physical science over the economy of knowledge.[245]

By modifying the religious vocabulary of an earlier age to craft new idols of "nature", "fact", "reality", "sense data" and so forth, epistemology stuffed the human and nonhuman relations involved in the construction of scientific facts or the political economy of experimentation into a black box and then closed the lid down tightly. A core of fetishism was built up in centres of European power as much around notions of scientific reality as around notions of price. In a spectacular irony, the quasi-religious sense of "fact" constructed by epistemology became taken, not least among environmentalists, as a guarantee for the rational discussion that it in fact hampered. In today's Europe, as critic John Gray observes, it is this metaphysically-endowed "science", not religion, that "has the power to silence heretics":

> "Like the Church in the past, it has the power to destroy, or marginalize, independent thinkers . . . this . . . is undoubtedly the chief source of science's appeal. For us, science is a refuge from uncertainties, promising – and in some sense delivering – the miracle of freedom from thought, while churches have become sanctuaries for doubt."[246]

Not the least effect of this development was to put a new bit of theory around the sense of superiority that modern Europeans needed to feel toward both their benighted ancestors and their colonial subjects. Epistemology reassured them that views about energy and other subjects held by, say, Aristotle, or rice farmers in South Asia, were simply "mistakes" that scientific progress, respect for "facts" and closer contact with the "real" could overcome.

New flavours of chauvinist ideology proliferated, centred on

alternatives at all", or that pretend to be able to make decisive inroads against the oppression inherent in energy extractivism and fossil-fueled industrialism by applying "principles of best practice" or "safeguards". His words were a classic, if unintended, manifestation of Miranda Fricker's "hermeneutical injustice".

. . . and Other Modern Beasts

the notion of progress. On a view that linked British Whigs and German romantics of the 19th century with 20th- and 21st-century *Time* magazine writers, as well as many Marxists, history became what Indian political psychologist Ashis Nandy calls an ascent along an "inclined plane" leading all societies – to borrow the satirical words of Harvard economist Stephen Marglin – "to the mountaintop of the modern West, with non-European peoples spread out along the slopes behind."[247] The difference between people who owned machines doing thermodynamic work and those who didn't, instead of being a distinction between those who were able to benefit from unequal exchange and those who weren't, became a distinction between people who inhabit the present and people who inhabit the past.[248]

All this powerfully reinforced what the great British social historian E. P. Thompson called the "enormous condescension of posterity" within European society toward figures who had failed to prevail in complex past conflicts involving energy, such as "the poor stockinger, the Luddite cropper, the 'obsolete' hand-loom weaver, the 'utopian' artisan".[249] This condescension prevented lessons from being learned about how energy struggles in Europe's own history had been won or lost. Instead, a lazy sense prevailed that, merely by being alive in the present, people had superseded the past and therefore had no need to engage it in dialogue.

One reason it has been difficult to contest modern notions of "language" and "fact" is that some of the phenomena that underpin them, while helping to open the way for novel types of invidious comparison and racism, have been, in other senses, enormously liberating – including to many in the global South.

As political scientist Benedict Anderson recounts, the rise of newspapers and other manifestations of "print capitalism" worldwide reinforced the conditions for the rise of the notion that items such as nations, monarchs and even human beings were members of an "unbounded series" extending across a secular, shared universe. The *lingua franca* that newspapers developed to report world events made it possible for local as well as world readers to imagine, for instance, the Lion of Judah and the Son of Heaven as members of the series "monarchs", and on a par with each other. This happened in central Java – to cite one particular place and time – sometime before 1920, when it became possible, quite suddenly and for the first time, to talk about "a" republic, "a" nation, "a" government official, "a" typist, "a" free individual as one of an unlimited series of similar instances, all following their destinies "within a single frame of time"[250] and along a single spatial grid that extended worldwide.

Languages also became members of such series: "Dutch had to descend from its status as the language of colonial power, and Javanese from its position as the language of ancestral truth."[251] A concept like "energy" could be named indifferently in Dutch, Malay or Javanese, revealing "an understanding of life then very new: that languages are transparent to each other, interpenetrate each other, map each other's domains – at an equal remove from, or proximity to, the material world." Rapidly, and without the transformation being much analyzed, words like *boeono* changed their "semantic load." Instead of meaning something like "cosmos", a "natural vertical universe arranged hierarchically from the Deity, or deities, down through kings, aristocrats, and peasants, to fauna and flora and the landscapes in which they were embedded", *boeono* became used to signify "world", a "horizontal universe of visible and invisible human beings from which volcanoes, demons, water buffalo, and divinities had vanished".[252]

As Anderson points out, this change was enormously liberating in many senses. To be an instance of a series like "nationalist" was to be part of a world in motion, a single global activity called "politics", with correlates everywhere, regardless of one's roots, gender, religion or skills. "A" liberation movement was possible anywhere, among similar liberation movements. Becoming someone who could have a changeable "profession" was experienced by millions as opening new territories of freedom.

Activists who are inheritors of such partly capitalist-derived traditions of unbounded series (with all their potential for encouraging epistemology, commensuration and "inclined plane" views of history as universal liberation struggles) but also defenders of a generally counter-capitalist vernacular can benefit from recognising how profoundly variegated the conversations in their own heads are. Coherence may be difficult, but resistance to slogans and simplification is essential.

In the context of a strategy meeting of experienced energy activists with a social movement background, the moderator's remark might well seem trivial. It had no discernible effect on the majority of the meeting participants, who continued to seek ways of working together that would honour the Canadian presenter's analysis. Yet it signalled a persistent problem of structural disrespect that pervasively hampers analysis and communication across the "energy alternatives" debate worldwide. It was of a piece, for example, with the slogan of UK government adviser David MacKay (Table 2) that talking about different energy alternatives is fine, but only as long as they all "add up" according to criteria laid down by an aggressive regime of scarcity and capital accumulation. It dovetailed with the hectoring "make sense?" question that US blogger David Roberts uses (p. 20) to convey his assumption that the energy use of a society has to be managed by making sure its energy intensity is declining faster than its economy is growing, and with Amory Lovins's dismissal of critics of efficiency as being ignorant of economics. It also reflected incongruous gaps within the meeting itself: when participants accustomed to such issues as challenging tar sands development ventured onto the territory of "alternatives", many still tended to seek answers in centralized exercises matching supply and demand, or "population" and "resources", or "available technology" and "political will", rather than to question dominant practices of energy and resources themselves.

For nearly everybody confronted with the question of energy alternatives, it remains a challenge to understand the full range of what is being asked and to find ways of making the debate more democratic. To move forward, it is necessary to do more than just outline the radical diversity of the issues and the problems that this diversity poses for dominant norms of negotiation (as this report has done), and more than just gesture toward a vantage point that might give a yet more panoramic view of the territory. Breaking out of the cage in which the industrial practices identified as "energy" have tended to confine the debate, and understanding these practices as being constituted by a process of crisis, requires looking in more detail at their history and politics. That will a job for succeeding publications.

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120. Nordhaus et al. note that the full scale of Jevons effects are "only visible at greater scope and complexity". While even limited, highly-simplified quantitative methods have found effects "across a relatively wide range of national economies to be on the order of 30-50 per cent or greater, with a surprising number projecting backfire (rebound greater than 100 per cent)", a wider-scale quantitative study "projects that global efforts to capture 'no-regrets,' below-cost energy savings opportunities will trigger rebound effects that collectively erode more than half (52 per cent) of projected energy savings potential by 2030." For Jevons effects to remain, as they are, "almost entirely ignored in projections of energy efficiency's ability to drive lasting reductions in energy use or greenhousegas emissions" is "remarkable"; yet these quantitative studies are likely, if anything ". . . to have underestimated the potential for economy-wide rebound, given that they are currently restricted by exogenous assumptions about the scale of direct rebound and other key factors and are limited to modeling 'pure' energy productivity improvements without considering the potential for multi-factor productivity improvements from energy-saving technologies to trigger even greater rebound or even backfire . . . total, economy-wide rebound at a global scale will likely be somewhat larger than even the most sophisticated global integrated models are able to project. The general trend . . . is that as analysis expands in both scope and complexity over time, larger rebound effects are discovered . . . while the work of theorists ultimately relies on contested economic frameworks and may never prove conclusive, theoretical inquiries into rebound effects consistently indicate that when energy efficiency measures are aggregated over the global scale and multi-decadal timeframes that matter most to climate and energy security objectives, total economy-wide rebound is likely to be quite large, even leading to backfire in certain circumstances" (Ted Nordhaus, Michael Shellenberger and Jesse Jenkins, *Energy Emergence: Rebound and Backfire as Emergent Phenomena*, The Breakthrough Institute, Oakland, 2011).

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133. On the latter, *see* David Wiggins, *Needs, Values, Truth*, Oxford University Press, Oxford, 1987, and Henry L. Richardson, *Practical Reasoning about Final Ends*, Cambridge University Press, Cambridge, 1997.

134. The "risk-averseness" that many students of rural societies see in peasant communities stems perhaps less from a different weighting of the numbers than might appear in, say, agricultural experts' risk/reward ratios than from an awareness that narrative is what rational human beings aware of the limits of calculation have to rely on. Of late, of course, calculational hubris has become a widespread concern among experts in finance such as John Kay, who observes that "the voices of the wise who know that they do not know are often drowned out by the ignorant who do not know they do not know. The right approach is not to peer more carefully into the crystal ball: there is nothing to see" (*Financial Times*, 29 May 2007).

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136. Benjamin Sovacool and Charmaine Watts, "Going Completely Renewable: Is It Possible (Let Alone Desirable)?", *Electricity Journal* , Vol. 22, No. 4, 2009, pp.95-111; http://www.precaution.org/lib/going_renewable.101228.pdf, p.107.
137. Ivan Illich, *Shadow Work*, Marion Boyars, London, 1981, p.87.
138. Ibid., p.92; Raymond Williams, *Keywords: A Vocabulary of Culture and Society*, Fontana, London, 2010, p.315.
139. Alf Hornborg, *Global Ecology and Unequal Exchange: Fetishism in a Zero-Sum World*, Routledge, London, 2011, p.32.
140. Nicholas Hildyard and Larry Lohmann, "The Museum of Fetishes", The Corner House, Dorset, http://www.thecornerhouse.org.uk/sites/thecornerhouse.org.uk/files/The%20Museum%20of%20Fetishes.pdf.
141. "The Original Futurama", *Wired*, Issue 15.12, 27 November 2007, http://www.wired.com/entertainment/hollywood/magazine/15-12/ff_futurama_original.
142. Michael Grubb, Jonathan Kohler and Dennis Anderson, "Induced Technical Change in Energy and Environmental Modeling: Analytical Approaches and Policy Implications", *Annual Review of Energy and Environment*, 2002, http://www.econ.cam.ac.uk/rstaff/grubb/publications/J34.pdf .
143. David Goodstein's analogy between the challenge of "kicking the fossil fuel habit altogether" and the challenge of putting a person on the moon is an example of such thinking. Goodstein writes: "In 1960, John F. Kennedy challenged us to put a human being on the moon within that decade. And we did it! That was possible because we already knew the basic principles of how it could be done. There were formidable technological obstacles to overcome, but we are very, very good at overcoming that kind of obstacle when we put our minds to it. The energy problem is of exactly that nature".
144. David E. Nye, *Consuming Power: A Social History of American Energies*, MIT Press, Cambridge, 2001, pp.5-6.
145. Ibid.
146. Ibid.
147. "Germany's Energiewende", Momentum, Institute on the Environment, University of Minnesota, Fall 2012, p.13, http://www.environment.umn.edu/momentum/issue/4.2f12/momentum_fall12.pdf. For discussions of community ownership of solar and wind projects, *see* David Elliott, *A Solar World: Climate Change and the Green Energy Revolution*, Schumacher Briefings 10, Totnes, Devon, pp.40-41; Dave Toke, "Supporting Renewables: Local Ownership, Wind Power and Sustainable Finance" *in* David Elliott (ed.), *Sustainable Energy: Opportunities and Limitations*, Palgrave Macmillan, London, 2007.
148. David E. Nye, *Consuming Power: A Social History of American Energies*, MIT Press, Cambridge, 2001, p.175.
149. Construction on the plant at Zwetendorf was begun in 1972, but in 1978, the Austrian Parliament voted in favour of a 20-year ban on the use of nuclear power in Austria. In 1997, the Austrian Parliament unanimously voted to remain a non-nuclear country.
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151. Robert Ozanne, *A Century of Labor-Management Relations at McCormick and International Harvester*, University of Wisconsin Press, Madison, 1967.
152. Langdon Winner, "Do Artifacts Have Politics?", *Daedalus*, Vol. 109, No. 1, Winter 1980, available at http://zaphod.mindlab.umd.edu/docSeminar/pdfs/Winner.pdf.
153. David F. Noble, *Forces of Production: A Social History of Industrial Automation*, Transaction Publishers, New Brunswick, New Jersey, 2011.
154. Ibid.
155. Quoted in the *New York Herald Tribune*, 1970.
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157. Ibid.
158. Tracey Clunies-Ross and Nicholas Hildyard, *The Politics of Industrial Agriculture, Earthscan, London*, 1992.
159. *See*, for example, Robert Caro, *The Power Broker: Robert Moses and the Fall of New York*, Vintage, New York, 1975.
160. Scientist writing in *Collier's Magazine*, 1940, quoted in David E Nye, *Narratives and Spaces: Technology and the Construction of American Culture*, University of Exeter Press, 1997, p.81.
161. "Universal Access to Energy would Herald Enormous Economic and Social Benefits", International Energy Agency, 14 June 2012, http://www.iea.org/newsroomandevents/news/2012/june/name,27722,en.html. The IEA's obligatory disclaimer that technology is not a determinant of change ("Electrification and access to modern energy services do not per se guarantee poverty alleviation") is belied by its technocratic approach. *See* International Energy Agency, *World Energy Outlook 2002*, Chapter 13: "Energy and Poverty", p.365, http://www.worldenergyoutlook.org/media/weowebsite/energydevelopment/WEO2002Chapter13.pdf.
162. Practical Action, "Energy for All 2030", http://practicalaction.org/energy-for-all-2030-project.
163. Kolya Abramsky (ed.), *Sparking a Worldwide Energy Revolution: Social Struggles in the Transition to a Post-Petrol World*, AK Press, Oakland, 2010, p.8.
164. Donald McDonald (ed.), *Electric Capitalism: Recolonising Africa on the Power Grid*, Earthscan, London, 2009, free download from www.hscrcpress.ac.za.
165. Kolya Abramsky (ed.), *Sparking a Worldwide Energy Revolution: Social Struggles in the Transition to a Post-Petrol World*, AK Press, Oakland, 2010, p.21.
166. Alf Hornborg, *Global Ecology and Unequal Exchange: Fetishism in a Zero-Sum World*, Routledge, London, 2011, p.43.
167. Bruno Latour, *We Have Never Been Modern*, Harvard University Press, Cambridge, MA, 1994.
168. Benjamin Sovacool and Charmaine Watts, "Going Completely Renewable: Is It Possible (Let Alone Desirable)?", *Electricity Journal* , Vol. 22, No. 4, 2009, pp.95-111, http://www.precaution.org/lib/going_renewable.101228.pdf.
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171. Ibid., p.115.
172. Joe Romm, "Bill McKibben and Betsy Taylor on the Merger of 350.org and 1Sky", *Climate Progress* website, 7 April 2011, http://thinkprogress.org/climate/2011/04/07/207849/bill-mckibben-betsy-taylor-merger-350-org-1sky/?mobile=nc.
173. Sureerat Taechooprakul, *Chaaw Prachuap Kho Kamnot Anaakhot khong Tua Eng* [Prachuab People Determine Their Own Future], Offset Creations, Bangkok, 2010, p.69.
174. Ibid.
175. *See* http://www.youtube.com/watch?v=kTKn1aSOyOs.
176. David Dickson, *Alternative Technology*, Fontana/Collins, Glasgow, 1974. Extracts are available at http://images.universitypix.multiply.multiplycontent.com/attachment/0/SATS4AoKCIAAAFQD9no1/4.3.b-INTERMEDIATE%20TECHNOLOGY%20AND%20THE%20THIRD percent20WORLD.doc?key=universitypix:journal:23&nmid=91340946.
177. Peter Bunyard, "The Coal-Equivalent Mentality", *The Ecologist*, Vol. 8, No.2, March/April 1978, p.45, available from http://www.theecologist.org/archive/19701999/.
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179. Ibid.
180. The literary and rhetorical devices used in such storytelling may appear different from those employed in, say, television dramas, but, in many respects, they are the same. As policy specialist James A. Throgmorton notes of the "report for ministers" style of narrative: "When we use surveyed samples to represent whole populations, we are using synecdoche (substitution a part for a whole"). When we use computer models to stimulate electric power usage patterns, we are using metaphor (an implied comparision between two things of unlike nature). When we confidently forecast future demand for electric power, while knowing that our prior forecasts proved far off the mark, we are being – whether we know it or not – ironic (conveying a meaning opposite to that which is intended)" (James A. Throgmorton, *Planning as Persuasive Storytelling: The Rhetorical Construction of Chicago's Electric Future*, The University of Chicago Press, Chicago, 1996, p.50).
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182. Michael Grunwald, "Seven Myths about Alternative Energy", *Foreign Policy*, September/October 2009, http://www.foreignpolicy.com/node/45093.
183. Vaclav Smil, *Energy at the Crossroads: Global Perspectives and Uncertainties*, MIT Press, Cambridge, MA, 2003, pp.121, 143, 146.
184. Ted Trainer, *Renewable Energy Cannot Sustain a Consumer Society*, Springer, 2010, p.3.
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188. Ibid., p.39.
189. Ibid., p.24.
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191. Mark Z. Jacobson and Mark A. Delucchi, "Providing All Global Energy with Wind, Water, and Solar Power, Part I: Technologies, Energy Resources, Quantities and Areas of Infrastructure, and Materials", *Energy Policy* Vol. 39, 2011, http://www.stanford.edu/group/efmh/jacobson/Articles/I/JDEnPolicyPt1.pdf; Mark Z. Jacobson and Mark A. Delucchi, "Providing All Global Energy with Wind, Water, and Solar Power, Part II: Reliability, System and Transmission Costs, and Policies", *Energy Policy* Vol. 39, 2011, http://www.stanford.edu/group/efmh/jacobson/Articles/I/DJEnPolicyPt2.pdf. *See also* Mark Z. Jacobson and Mark A. Delucchi, "A Path to Sustainable Energy by 2030", *Scientific American*, November 2009, http://www.stanford.edu/group/efmh/jacobson/Articles/I/sad1109Jaco5p.indd.pdf.
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196. World Wide Fund for Nature/Ecofys, *The Energy Report 2011: 100 per cent Renewable Energy by 2050*, 2011, http://assets.panda.org/downloads/the_energy_report_lowres_111110.pdf , p.79.
197. Ted Trainer, *Renewable Energy Cannot Sustain a Consumer Society* , Springer, 2010, p.4.
198. Vaclav Smil, *Energy Transitions: History, Requirement, Prospects*, Praeger, 2010.
199. Mark Z. Jacobson and Mark A. Delucchi, "Providing All Global Energy with Wind, Water, and Solar Power, Part I: Technologies, Energy Resources, Quantities and Areas of Infrastructure, and Materials", *Energy Policy*, Vol. 39, 2011, http://www.stanford.edu/group/efmh/jacobson/Articles/I/JDEnPolicyPt1.pdf; Mark Z. Jacobson and Mark A. Delucchi, "Providing All Global Energy with Wind, Water, and Solar Power, Part II: Reliability, System and Transmission Costs, and Policies", *Energy Policy*, Vol. 39, 2011, http://www.stanford.edu/group/efmh/jacobson/Articles/I/DJEnPolicyPt2.pdf.
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of Infrastructure, and Materials", *Energy Policy,* Vol. 39, 2011, http://www.stanford.edu/group/efmh/jacobson/Articles/I/JDEnPolicyPt1.pdf; Mark Z. Jacobson and Mark A. Delucchi, "Providing All Global Energy with Wind, Water, and Solar Power, Part II: Reliability, System and Transmission Costs, and Policies", *Energy Policy*, Vol. 39, 2011, http://www.stanford.edu/group/efmh/jacobson/Articles/I/DJEnPolicyPt2.pdf, Table 4, p.1163; A. M. Diederen, "Materials Scarcity: A Sobering Perspective", Presentation to TMCE Conference, Ancona, 12 April 2010, http://www.platform-materiaalschaarste.nl/dossies-en-publicaties/documenten/Materials-scarcity-Ancona-2010-Diederen.pdf.

202. Ted Trainer, *Renewable Energy Cannot Sustain a Consumer Society*, Springer, 2010.

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203. M. Thompson, M. Warburton and T. Hatley, *Uncertainty on a Himalayan Scale*, Ethnographica, London, 1986, p.71. The authors continue: "What is needed is . . . an approach that places the 'mere details' . . . at the very centre of the stage and relegates to the wings the alarm bell-ringers and their immaculate prescriptions" (pp.87-88).

204. Ivan Illich, *Shadow Work*, Marion Boyars, London, 1981, p.73.

205. Donald McDonald (ed.), *Electric Capitalism: Recolonising Africa on the Power Grid*, Earthscan, London, 2009, free download from www.hscrcpress.ac.za.

206. "Trinational Workshop on Energy", Accion Ecologica and Universidad Andina Simon Bolivar, Quito, November 2012.

207. Evo Morales, *The Earth does not Belong to Us, We Belong to the Earth: Messages from President Evo Morales Ayma about* Pachamama *(the Mother Earth) and Climate Change*, 2006-2010, Bolivia, Ministry of Exterior Relations, La Paz, 2010.

208. Pablo Solon, "Strike Four for Climate Change Negotiations: Rethinking our Strategies", *Hoy es Todavia*, 18 December 2012, http://links.org.au/node/3160.

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211 Alf Hornborg, *Global Ecology and Unequal Exchange: Fetishism in a Zero-Sum World*, Routledge, London, 2011, p.13.

212. Dale Wen, "China and Climate Change – Spin, Facts and Realpolitik" in *Climate, Development and Equity* (What Next Vol. 3), *Development Dialogue* , September 2012, pp.125-45, pp.138, 140.

213. *See* Patrick Bond, "Reformist Reforms, Non-Reformist Reforms and Global Justice: Activist, NGO and Intellectual Challenges in the World Social Forum", Societies Without Borders No. 3, 2008, pp.4–19. In *The Year of Living Dangerously* (Verso, London, 2012), Slovene thinker Slavoj Zizek observes that for movements such as Occupy Wall Street, the art of politics can involve insisting "on a particular demand that, while thoroughly 'realistic', disturbs the very core of the hegemonic ideology, that is, which, while in princple feasible and legitimate, is de facto impossible (universal health care, for example)" (p.84).

214. Patrick Bond, "Reformist Reforms, Non-Reformist Reforms and Global Justice: Activist, NGO and Intellectual Challenges in the World Social Forum", *Societies Without Borders* No. 3, 2008, pp.4–19.

215. Elinor Ostrom, "Polycentric Systems for Coping with Collective Action and Global Environmental Change", *Global Environmental Change*, Vol. 20, 2010, pp.550–57.

216. Jonathan Neale (ed.) *One Million Climate Jobs: Solutions to the Economic and Environmental Crises*, Campaign against Climate Change Trade Union Group, London, 2010.

217. Slavoj Zizek, *Violence*, Profile Books, London, 2009, p.129.

218 Ibid., pp.133-34. *See also* M. K. Gandhi, *The Economics of Khadi*, Navajiva, Ahmedabad, 1941; Shiv Visvanathan, "Environmental Values, Policy, and Conflict in India", Carnegie Council on Ethics and International Affairs, Washington, DC, 2000, http://www.carnegiecouncil.org/publications/articles_papers_reports/709.html/_res/id=sa_File1/.

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219. Slavoj Zizek, *Violence*, Profile Books, London, 2009, p.84.

220. *See*, for example, Ivonne Yanez, interview with Cesar Pilataxi, Kayambi leader, Quito, Ecuador, 9 October 2012, available from The Corner House.

221. Raymond Williams, *Keywords: A Vocabulary of Culture and Society*, Fontana, London, 2010, p.17.

222. Ivan Illich, "The Social Construction of Energy", *New Geographies*, No. 2, 2009, pp.13-19, p.13; *see also* Ivan Illich, *Energy and Equity*, Calder and Boyars, London, 1974. There are, of course, many other contemporary thinkers who have spent their lives excavating and clarifying such differences. Benedict Anderson's studies of Southeast Asian and world history, for example, are inspired not only by Marx but also by the literary critic Erich Auerbach's work on the radically different mentalities observable in the history of European literature (*Mimesis*, Princeton University Press, Princeton, 1957).

223. Quine's work on language is represented by *Word and Object*, MIT Press, Cambridge, MA, 1960 and *Ontological Relativity and Other Essays*, Columbia University Press, New York, 1969, Davidson's by a set of highly-compressed papers collected in five volumes published by Oxford University Press, including *Inquiries into Truth and Interpretation*, Oxford University Press, Oxford, 2001.

224. Donald Davidson, *Inquiries into Truth and Interpretation*, Oxford University Press, Oxford, 2001, p.238.

225. Richard Rorty, *Consequences of Pragmatism*, University of Minnesota Press, Minneapolis,1982, p.6.

226. The late anthropologist Darrell Posey once related, for instance, how one of his Brazilian Kayapo informants once contested Posey's Portuguese-language claim that Kayapo "planted" certain forest trees and epiphytes.

On further discussion, it emerged that the disagreement centered not on how the Kayapo behaved physically toward seeds, but was at another level. As the informant explained, "only plants that could not grow without the help of humans are planted; all other species are 'natural'". His first strategy for interpreting Posey's interpretation – pairing up the Portuguese words for "planted" or "domesticated" with the obvious Kayapo "dictionary" equivalents – had compelled him to attribute odd beliefs to Posey. Alternatively, he could have started out by assuming Posey was right about Kayapo planting practices, but would then have been led to spin out inconveniently long Kayapo glosses on what had seemed simple words. The dispute arrived at a further temporary resting point only after long intercultural discussion. *See* Darrell Posey, "Interpreting the 'Reality' of Indigenous Concepts", *in* Kent H. Redford and Christine Padoch (eds.) *Conservation of Neotropical Forests: Working from Traditional Resource Use*, Columbia University Press, New York, pp.21-34, pp.22-24. *See also* Stacey Leigh Pigg, "Inventing Social Categories through Place: Social Representations and Development in Nepal", *Comparative Studies in Society and History*, 1992, pp.504-530.

227. W. v. O. Quine, *Ontological Relativity and Other Essays*, Columbia University Press, New York, 1969, p.34.

228. Such 1984-type predicaments are widespread elsewhere as well. For example, after independence, Indonesia's Ministry for Language Development tried to impose the word *bekerdja* as a replacement for half a dozen other words much more entangled with commons activities than with commodity labour, as part of its attempt to create a working class. As Illich relates, people nevertheless continued to refer to what they did with "different terms for pleasurable, or degrading, or tiresome, or bureaucratic actions – whether they are paid or not." In Latin America, Illich continues, "people find it easier to perform the paid task assigned to them than to grasp what the boss means by *trabajo*. For most toiling unemployed in Mexico, *desempleado* still means the unoccupied loafer on a well-paid job, not the unemployed whom the economist means by the term" (Ivan Illich, *Shadow Work*, Marion Boyars, London, 1981, p.101).

229. This section relies heavily on Carolina Valladares, *Ecuadorian Public Policy toward Good Living: An Interpretive Policy Analysis of Large-Scale Mining Conflict*, MA thesis, University of Twente, 2013. For background, see Anthony Bebbington and Denise Humphreys Bebbington, "An Andean Avatar: Post-Neoliberal and Neoliberal Strategies for Securing the Unobtainable", *New Political Economy*, Vol 16, No. 1, 2011.

230. "Crimethink" in this case is no overstatement: indigenous mining protesters are increasingly facing criminal charges as a result of their opposition to state mining policy.

231. Rafael Correa, public speech, December 2012, http://www.correodelorinoco.gob.ve/multipolaridad/rafael-correaapuesta-por-extraccion-recursosnaturales-no-renovables/.

232. Humberto Cholango, interview, March 2012, http://prensa.politicaspublicas.net/index.php/alatina/?p=11307&more=1&c=1&tb=1&pb=1.

233. Donald Davidson, *Inquiries into Truth and Interpretation*, Oxford University Press, Oxford, pp.137, 168-9, 197.

234. Stephanie Gorson Fried, "Writing for their Lives: Bentian Dayak Authors and Indonesian Development Discourse", *in* Charles Zerner (ed.), *Culture and the Question of Rights: Forests, Coasts, and Seas in Southeast Asia*, Duke University Press, 2001, pp.142-183.

235. Miranda Fricker, *Epistemic Injustice: Power and the Ethics of Knowing*, Oxford University Press, Oxford, 2010, pp.152-4. *See also* Nancy Fraser, *Scales of Justice: Reimagining Political Space in a Globalizing World*, Columbia University Press, New York, 2008.

236. Miranda Fricker, *Epistemic Injustice: Power and the Ethics of Knowing*, Oxford University Press, Oxford, 2010, pp.159-60. Fricker relies on the account in Susan Brownmiller, *In Our Time: Memoir of a Revolution*, Dial Press, New York, 1990.

237. James C. Scott, *Domination and the Arts of Resistance: Hidden Transcripts*, Yale University Press, New Haven, 1990.

238. Miranda Fricker, *Epistemic Injustice: Power and the Ethics of Knowing*, Oxford University Press, Oxford, 2010, p.151.

239. John Berger, "Afterword" *in* Andrey Platonov, *Soul*, New York Review Books, New York, 2007, p.317.

240. Alf Hornborg, *Global Ecology and Unequal Exchange: Fetishism in a Zero-Sum World*, Routledge, London, 2011, p.10.

241. *See* Larry Lohmann, "For Reasons of Nature: Ethnic Discrimination and Conservation in Thailand", The Corner House, 2000, http://www.thecornerhouse.org.uk/resource/reasons-nature. As an aphorism of science scholar Donna Haraway has it, "facts are theory-laden; theories are value-laden; values are history-laden."

242. Boaventura de Sousa Santos, "The Future of the World Social Forum: The Work of Translation", *Development*, Vol. 48, No. 2, 2005, pp.15–22. It is worth quoting de Sousa Santos's elaboration of this idea at length: "For cultural, social and political reasons specific to our time it is possible to reach a broad consensus around the idea that there is no general, all-encompassing theory of social transformation. Without this consensus – the only kind of legitimate (negative) universalism – translation is a colonial kind of work no matter how postcolonial it claims to be . . . In view of the history of progressive politics in the 20th century, it is probably unavoidable that unequal relations of power are present in the first steps of the construction of . . . social fields in which different movements/organizations meet and interact to reciprocally evaluate their normative aspirations, their practices and knowledges. The work of translation will be possible to the extent that the unequal power relations yield to relations of shared authority . . . When social transformation has no automatic meaning and neither history nor society or nature can be centrally planned, the movements have to create through translation partial collective meanings that enable them to coalesce on courses of action that they consider most adequate to bring about the kind of social transformation they deem most desirable . . . The objective of the translation work is to nurture among progressive social movements and organizations the will to create together knowledges and practices strong enough to provide credible alternatives to neo-liberal globalization."

243. Richard Rorty, *Philosophy and the Mirror of Nature*, Princeton University Press, Princeton, 1979, p.268.

244. Alf Hornborg, *Global Ecology and Unequal Exchange: Fetishism in a Zero-Sum World*, Routledge, London, 2011, p.141. *See also* Stephen Gudeman, *Economics as Culture: Models and Metaphors of Livelihood*, Routledge, London, 1986.

245. Conventional economics, like epistemology, "proceeds on the assumption that all contributions to a given discourse are commensurable", or "able to be brought under a set of rules which will tell us how rational agreement can be reached on what would settle the issue on any point where statements seem to conflict". All residual disagreements become noncognitive, verbal, emotional, merely temporary (Richard Rorty,

Consequences of Pragmatism, University of Minnesota Press, Minneapolis,1982, p.316).

246. John Gray, *Straw Dogs: Thoughts on Humans and other Animals*, Granta, London, 2003, p.19, quoted in Slavoj Zizek, *Violence*, Profile Books, London, 2009, p.69.
247. Stephen Marglin, *The Dismal Science: How Thinking like an Economist Undermines Community*, Harvard University Press, Cambridge, MA, 2010, p.150.
248. Alf Hornborg, *Global Ecology and Unequal Exchange: Fetishism in a Zero-Sum World*, Routledge, London, 2011; Johannes Fabian, *Time and the Other: How Anthropology Makes Its Object*, Columbia University Press, New York, 1983.
249. E. P. Thompson, *The Making of the English Working Class*, Penguin, London, 1980 [1963], p.12.
250. Benedict Anderson, "Nationalism, Identity and the Logic of Seriality", in *The Spectre of Comparisons: Nationalism, Southeast Asia and the World*, Verso, London, 1998, pp.29-45, p.30.
251. Ibid., p.31.
252. Ibid.

“This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of The Corner House and can in no way be taken to reflect the views of the European Union.”


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