ENERGY AND INGENUITY

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Energy is our life-blood. Without an adequate supply at the right times and places, our economy and society would grind to a halt. Canadians are profligate users of energy: in fact, we have one of the highest per capita rates of consumption in the world. But if we were smarter about things, we would consume much less energy to support our current standard of living, and we would produce this energy with much less damage to our natural environment.

What does it mean to be smarter about things? Over the last decade, I've given a lot of thought to this question. I've tried to understand why some people and societies are good at solving problems while others aren't. A key factor, I've decided, is the ability to generate and implement practical ideas. I call these practical ideas *ingenuity*, and people, organizations, and societies that can't supply enough ingenuity at the right times and places face an *ingenuity gap*.[1] This perspective helps us understand why we're finding it so hard to change our energy habits.

Ingenuity, as I define it, consists of sets of instructions that tell us how to arrange the stuff in our world in ways that help us achieve our goals. Ingenuity is like cooking recipes, and these recipes allow us to manipulate, process, and reconfigure the matter around us—the materials in the ground, the gases that in the atmosphere, and the organic components of our biosphere—into things that improve our lives.

Take, for example, the laptop computer that I'm working on at the moment. By itself, this device probably has more power than all the computers available to the U.S. Defense Department in the 1960s taken together. Yet it consists of nothing more than reconfigured rock and hydrocarbons. We have extracted materials from the ground and, by following an immensely long and elaborate set of instructions, refined and manipulated them into the remarkable device sitting in front of me. The same is true for every human-made thing around us, including the lights above our heads, the furniture we're sitting on, and the food on our plates.

If *technicalingenuity* consists of recipes for reconfiguring matter to make technologies like laptops, cars, and furniture, then *socialingenuity* consists of recipes that tell us how to arrange people to form key organizations and institutions, like court systems, markets, and parliamentary democracies. Although ideas for new technologies tend to attract most of our attention, it turns out that social ingenuity is more important. In fact, social ingenuity is a prerequisite for technical ingenuity: we don't get the new technologies we want unless our economic institutions—especially our markets—reward innovators for the risks they take; and well-functioning markets take huge amounts of ingenuity to design, set up, and run.

This ingenuity model subsumes, and is ultimately far more powerful than, the conventional neoclassical economic model that dominates policy discussion surrounding critical issues like energy. Within the economic model, human beings are defined as rational maximizers of their well being. The model's keystone concepts—concepts that we see everyday in the business pages of our newspapers—are consumption, production, investment, and savings. And its system inputs, what economists call factors of production, are capital and labor. (For economists, capital consists mainly of the machines used to make things like cars or laptops, while labor is the work applied to running these machines.) In general, conventional economists give little thought to the independent productive role of ideas.

In contrast, within the ingenuity model, human beings are defined as pragmatic problem solvers. The model's keystone concepts are ingenuity requirement and supply. And its system inputs—or what we might call factors of problem solving—are ideas, energy, and matter. Human beings use their *ideas* to guide the application of their *energy* to reconfigure the *matter* around them into the things that meet their needs. Within the economic model it sometimes seems that human beings are little more than walking appetites. But according to the ingenuity model our most important characteristic, and the thing that truly distinguishes us from other species, is our capacity to generate and implement ideas to solve our problems.

How can we use the ingenuity model to better understand the problem of energy consumption and production in Canada? For one thing, the model disciplines us to focus on two separate issues: the factors that boost our requirement for energy-related

ingenuity and the factors that hinder our ability to supply the needed ingenuity at the right times and places. The model also encourages us to recognize that the really big obstacles we face are social, not technical.

In the remainder of this brief chapter, I'm going to focus on why it's so hard for us to make the transition to "green" energy production, including solar, wind, micro-hydro, and land-fill methane power generation. The obstacles to green energy in Canada are mainly social, and the ingenuity we must supply to overcome them is also therefore mainly social.

Let's begin with the economic obstacles to green power. I believe there are two main ones: first, our energy prices don't reflect energy's true costs and, second, we need high consumption to sustain our economy. The first is a tough problem, but it's potentially solvable within the context of our current economic system. The second is far more intractable, because it goes to the very heart of the way modern capitalist economies function.

Green power could compete with conventional energy sources—such as oil, natural gas, coal, hydro, and nuclear—if the prices we paid for conventional energy accurately reflected the full costs of its production and use. At the moment, our society, the natural environment, and future generations are all providing huge subsidies to conventional energy. As Joyce McLean of Toronto Hydro says: "The crux here is that people are not paying the true cost of their [energy] bill. Green power, with no hidden costs, is far from being more expensive. But that's confusing to the average person."[2]

Economists use the term "negative externalities" to refer to costs not included in a good's price because they are borne by people not directly involved in producing, buying, selling, or using the good. For example, the prices of gasoline and electricity in Ontario don't reflect the cost to public health of air pollution produced when people burn gasoline to run their cars or fossil fuels to produce electricity. Similarly, these prices don't remotely reflect the likely cost of the climate change caused by the CO2 emitted when we burn gasoline or fossil fuels.

These external costs of energy generation are very high: public health officials estimate that air pollution in Toronto alone causes "between 730 and 1,400 premature deaths, and between 3,300 and 7,600 hospital admissions each year." They go on:

> These premature mortality and hospitalization estimates, while significant, greatly underestimate illness associated with poor air quality in Toronto. For the last 15 years, it has been well recognized that air pollution produces a "pyramid" of health effects, with the relatively rare but more serious health outcomes (such as premature deaths and hospitalizations) at the peak of the pyramid, and the less but more numerous health outcomes such as asthma symptom days and respiratory infections (such as pneumonia) appearing in progressive layers below that peak.[3]

A major study just released by the International Institute for Sustainable Development in Winnipeg puts numbers on some of these external costs. The results are impressive and important. The study used advanced methods of "full-cost accounting" to estimate the health and climate-change costs per kilowatt-hour of electricity generated in eastern Canada's thermal power plants. Even using a relatively limited tally of costs (since many of pollution's effects on health are almost impossible to estimate), the study shows that the full cost of producing electricity by burning coal is actually 50 percent higher than the current market cost.[4]

Much of this cost will be borne by our children and grandchildren in the form of poorer health and a damaged natural environment. This is a subsidy paid across time—paid by generations in the future to us in the present. Conventional energy is also heavily subsidized across economic sectors and geographic locations. For example, the Ontario public has been saddled with an immense debt from the construction of nuclear reactors, and it will be paying that debt through its Hydro bills every month *for decades*. And throughout Canada, urban residents are subsidizing the provision and maintenance of infrastructure, including energy infrastructure, in surrounding suburbs.

Not all subsidies are bad: they're sometimes needed to balance social fairness against economic efficiency. But the subsidies provided by hidden external costs produce all kinds of nasty results. When people do not pay the full costs of the production and use of a good, they have an incentive to waste it and a disincentive to apply ingenuity to conserve it. If conventional energy were properly priced, it would be far more expensive, and we would see a dramatic increase in the flow of ingenuity to conserve this energy and find alternatives to it. The short-run adjustment would be harsh—there would be major economic dislocations—but, in the medium to long run, Canadian society could be much wealthier, because all that new ingenuity would make our economy vastly more efficient and technically

advanced. We could also sell this energy-related ingenuity around the world.

Users of conventional energy are, in a sense, the biggest welfare bums in town. The corporations that produce this energy, and the industries and consumers who burn it, which means every one of us, are all on the dole. It's time to start paying our way.

We might be able to tackle the deeply rooted vested interests that benefit from, and rely upon, these subsidies. Through an immense effort of political and social will, it's just possible that we could reform our energy markets sufficiently to do the job. Unfortunately, though, that leaves us with the second economic obstacle: healthy capitalist economies rely upon ferociously high rates of consumption of goods and services; this tends to discourage a transition to a green economy whose principal aim is to lower the throughput of energy in the economy.

Understanding this obstacle requires a short digression on the nature of modern capitalism. Competition among firms encourages relentless technological innovation that in turn steadily boosts labour productivity: as companies try to win in a Darwinian marketplace, they often replace relatively expensive labour with new technologies. This means that an individual worker can produce more for the company, but it also means that redundant workers are laid off. In order to prevent this pool of technologically displaced labour from becoming too large and both a drag on the economy and a source of social unrest, new jobs must be created through economic growth. In other words, as some sectors of the economy use less and less labour, new sectors and enterprises must be created to absorb the displaced labour. And if these new sectors and enterprises are to prosper, there must be sufficient economic demand for their products.

Capitalist societies are therefore constantly engaged in demand creation. They must socialize their citizens to be insatiable consumers (the "walking appetites" of the neoclassical economic model discussed above). Advanced capitalism can only survive if it generates constantly rising material expectations and, in turn, chronic material discontent within the economically active population, despite increasing material abundance.

A large body of research shows that, beyond a modest threshold of per capita income (less than a third of the level in advanced economies), the correlation between greater wealth and greater happiness breaks down. If so, why are we—and our elites, policymakers, and governments—so obsessed with sustaining economic growth and generating endlessly greater wealth per capita? It's as if we've become addicted to buying things: the act doesn't really make us happy, except for a moment after the purchase, but we keep doing it over and over again anyway.

Western societies, and increasingly our global society as a whole, have locked themselves into an economic and social system that can remain stable only through endless growth. Without such growth and the constantly rising personal consumption that accompanies it, new jobs won't be created, economic demand will stagnate, and deflation will set in. (Note that the world economy is currently struggling with exactly this problem now: enormous excess productive capacity, vast pools of surplus capital and labor, insufficient demand to absorb these factors of production and, as a result, incipient deflation.) Moreover, the distributional struggles between rich and poor groups—struggles ever-present underneath the surface of societies with highly unequal distributions of wealth and power—could tear our societies apart: without the cultivation of insatiable desires, some technologically displaced labor will remain unemployed, which over time could produce a powerfully aggrieved and potentially revolutionary underclass.

In this macro-economic environment, appeals for energy conservation must climb a very steep hill. Conservation has a pejorative "each your peas" connotation. The not-so-subtle implication is that it's bad for the economy—and almost un-Canadian. We need to consume to grow, and we need to grow to be happy. Dealing with this problem will require advocates of green energy to revisit some fundamental issues about economic growth and the nature of capitalist economies that they've been reluctant to address since the aborted "limits to growth" debate of the 1970s.

If these economic obstacles to green energy are formidable, so are the political obstacles. Again I see two. First, the political and bureaucratic systems that form the environment within which advocates of green energy must press their case, and that generate the regulations governing green energy's deployment, are often hopelessly cumbersome and inefficient. Journalist Gordon Laird writes, for example, about the Toronto Renewable Energy Cooperative's attempts to get approval for a wind turbine at Ashbridge's Bay, east of Toronto:

> There are three levels of government, technical and compatibility problems, city bylaws that need be rewritten or revised, and a host of other

> complications. The growing list of government jurisdictions and departments requiring reports and approval is considerable—City of Toronto, Navigation Canada, Transport Canada, Toronto air port, Committee of Adjustment—and then there is the federal environmental assessment, a process that requires its own small mountain of paperwork and consultations. There's also a list of unwritten "unofficial approvals . . . wink-wink approvals you better have."[5]

Moreover, as was shown years ago by the economist Mancur Olson, over time, bureaucracies, political systems, and economies become more complex and rigid—even sclerotic—as they add layer upon layer of law and regulation, and as they accumulate competing and overlapping centres of authority. As years go by, powerful vested interests establish themselves in the niches of these systems and do everything they can to prevent change that will affect their interests.

Energy supply and use affect every person, group, and segment of society, so everybody has a powerful interest in these matters. In such an environment, it's very difficult to reach a political consensus, and it's very easy for powerful interest groups to derail reforms.

The second political obstacle arises, somewhat paradoxically, from green energy's greatest strength—its emphasis on small-scale, local, and decentralized energy production. Its advocates tend to be small, community-based, and loosely networked groups, with commensurately weak political clout. On the other hand, large centralized power projects—like nuclear stations, massive fossil-fuel generating plants, and hydroelectric dams—depend on huge corporations and government bureaucracies to build, run, and maintain them. These corporations and bureaucracies become concentrations of political and economic power in Canadian society, and too often they become immense and focused vested interests opposed to real reform of our energy practices. Green energy's advocates, in contrast, are often underfinanced, poorly coordinated, and ideologically diffuse. In the fierce political struggle over energy policy, they can't hope to win against very powerful, very rich, and very entrenched vested interests.

The four obstacles to green energy that I've identified here—two economic and two political—are formidable obstacles to change. Most fundamentally, they are formidable obstacles to the supply of the ingenuity we need to solve the energy problems we face. There are things, however, that we can do: Canadians can lobby their governments to adjust energy markets so that prices better reflect energy's true costs; they can work to streamline the political and bureaucratic decision-making processes that affect new energy policies; and green-power advocates can make their political action more coordinated and coherent, in order to counterbalance the deadweight of vested interests behind conventional energy.

But Canadians also need to reflect much more on our broader context of institutions, incentives, and values—a context that lead us, too often, to choose a mode of living that needs huge amounts of energy over one that treads more lightly on Earth.

[1] For a complete discussion, see Thomas Homer-Dixon, *The Ingenuity Gap: Can We Solve the Problems of the Future?* (Toronto: Knopf Canada, 2000), and Thomas Homer-Dixon, "The Ingenuity Gap: Can Poor Countries Adapt to Resource Scarcity," *Population and Development Review* 21, no. 3 (1995): 587-612.
[2] Quoted in Gordon Laird, *Power: Journeys Across an Energy Nation* (Toronto: Penguin Viking, 2002), p. 167.
[3] Sheela Basrur, "Air Pollution Burden of Illness in Toronto," City of Toronto (Toronto: Toronto Public Health, May 2000): i-ii.
[4] Henry David Venema and Stephan Barg, "The Full Costs of Thermal Power Production in Eastern Canada" (Winnipeg: International Institute for Sustainable Development, July 22, 2003).
[5] Laird, *Power*, p. 144. The phrases quoted in the last sentence are from Laird's interview with Bryan Young, general manager of the Toronto Renewable Energy Coalition.