

III: CONCLUDING COMMENTS

This exercise sought to construct an advocated scenario of global development for the next 150 years that addresses important questions regarding economic justice, ecological integrity, global governance and appropriate technology. The final scenario constructed is one in which the world of 2150 is characterized by:

- * high levels of per capita GDP;
- * equality of per capita GDP among countries;
- * the absence of poverty;
- * moderate and non-increasing economic inequality among individuals;
- * very slow economic growth;
- * stable world population;
- * moderately high and non-increasing levels of energy consumption;
- * high technological density;
- * a globally integrated, social-democratic/internationalist governance regime;
- * strong social controls over potentially destabilizing technologies;
- * a deeply embedded global ethos that supports these conditions.

The quantitative description of these scenario elements is shown in Boxes IA-17, IA-18 and IA-19, and identified there as Scenario 3. A summary quantitative description is shown on page 26 of the introductory section. The narrative description is summarized in Box IB-15, under the label “social democratic internationalism.”

This is not quite the scenario that I had hoped to be able to present when I began this exercise. I wanted to present a scenario showing lower levels of consumption, less economic inequality among persons, lower levels of energy use, and a less intense commitment to high technology. As discussed in the text, I wasn’t able to do this in a way that I believed was credible. The scenario does include two elements I had initially hoped to be able to include: equality of per capita GDP among countries and the elimination of poverty. Taken all together, I believe the scenario meets the criteria set out at the beginning of this exercise better than does any other scenario. I believe it can be seen as desirable, credible and compelling by large numbers of people.

Two objective factors played critical roles in shaping the scenario as finally presented. One was the enormous disparities of wealth and income among and within the countries of the world, as documented in Section II.B. The other was the relative abundance of energy resources, and more generally the lack of consequential limits to economic growth over the period of this scenario, as discussed in Section II.A. Together these factors made it difficult to argue that aggregate economic growth and consumption needed to be, or should be, strongly curtailed in the short to medium term. To do this would consign the developing world to a permanent state of profound economic inequality, unless the wealthy populations of the world were willing, or could be compelled, to redistribute considerable portions of their incomes. But in the absence of objective, absolute limits that would inexorably bring economic growth to an end within the next 150 years or so, I could not make a credible case that the world's wealthy populations (i.e., those in the top 20% of households), could be expected or compelled to do this to the extent required. As a consequence the scenario calls for economic growth to continue, at high globally aggregated rates, for most of the next century.

At a finer grain, however, the scenario does call for *curtailed* growth. It calls for economic growth in the wealthy countries to slow to 0.5% a year by the middle of the 21st century, and to stabilize at that low rate; and it calls for developing countries to stabilize at that same low rate a century later, after per capita income equality among all countries has been achieved.

This staged pattern of growth rate reduction is necessary if we hope to achieve economic equality among countries within the next 150 years at an aggregate level of resource use that is ecologically sustainable over the indefinite future, and that doesn't force us to rely on unacceptably problematic technologies. Conversely, a commitment to achieving equality among countries is a necessary precondition for any global agreements that seek to moderate economic growth, protect the environment or regulate technological innovation.

The scenario calls for a strong commitment to ensure that income inequality within the developed countries does not increase beyond its current level. The aggregate 80/20 ratio of the developed countries today is 6.5:1. Developed countries whose current 80/20 ratios are above 6.5:1, such as the United States and Australia, would be committed to reducing inequality to that level.

The scenario also calls for a commitment to ensure that inequality in the developing countries declines as they industrialize, until the advocated 80/20 ratio of 6.5:1 is reached. The aggregate 80/20 ratio of the developing countries today is about 8:1. Much of the desired decline in inequality can be expected to occur as large rural populations make the transition from agricultural to industrial modes of life. But structural and other policies will need to be called upon if necessary to ensure achievement of the distributive equity goal.

Are these conditions, taken as a whole, credible and desirable? The condition calling for slow growth in the wealthy countries by 2050 implies a new era in human values. It would require massive social and personal engagement towards that end. But it requires no cutting back—incomes are intended to grow, continuously.

I believe that this positive-but-slow growth scenario is more credible and desirable than are, for example, those Green sustainability scenarios which suggest that the growth of throughput or output must be brought to an end in the near or medium term future (i.e., within less than 150 years) in order to ensure sustainability.

I also believe that the positive-but-slow growth scenario is more credible and desirable than are scenarios of continued rapid economic growth, when the full implications of the rapid growth scenario are understood. The major problem with the rapid growth scenario is that it commits humankind to dependence upon a continually more complete technological transformation of the natural world—plants, animals, humans, and ecosystems—in ways that can be expected to be dangerously destabilizing, as described in Section II.E.

How about faster growth in the developing countries? Is it credible to imagine Asia, Africa and Latin America growing at steady rates of 3-5% for the coming seven decades? I believe it is. Here we appeal to the logic of well-functioning and well-regulated free markets, and to the historical experience of other countries and regions. Continued technological innovation and global economic integration should be expected to make important contributions. I also believe that social learning and human agency can work to encourage sustained growth at these rates.

Is it credible, however, to imagine economic growth in developing countries continuing at a fast pace (3-5%/yr) while growth in the developed countries is slowing down (from 2% to 0.5%)? The historical record might suggest not; over many periods the dynamism of the West has driven the rest. But this connection will become increasingly less important as the internal and regional markets of the developing countries continue to grow, and as they account for an increasingly larger share of global output.

What about inequality? The distribution of incomes in the developing countries should become more equal as these nations industrialize, as discussed in Section II.B.2. The distribution of income in developed countries is more problematic. Its future dynamics depend importantly on the extent to which ascendant technologies are skill-intensive. This is a new topic of research and difficult to model and quantify. It is possible that the distributional impact of technological innovation at the level of production will need to become a concern of public policy. Beyond this, we saw in Section II.B.3 that a broad range of policy tools ostensibly designed to reduce income inequality could be expected to do so only to a small extent. Section II.B.4 showed strong public opposition to those policies that would have a significant redistributive impact. However, the public also objects to the *growth* of income inequality, and it appears that the policy tools reviewed in Section II.B.3 should be capable of achieving this more modest but still challenging goal. These factors motivate “holding the line” on aggregate inequality as a credible scenario element.

However, while an 80/20 ratio of 6.5 may be acceptable to people anticipating historical levels of strong economic growth, is it acceptable at the same time that growth rates of per capita GDP are slowing from 2% to 0.5%? And as a permanent rather than a transient condition? This is a major unknown. One reason for rejecting no-growth scenarios was the difficulty of imagining ways in which distributive inequality of *any* level could be countenanced under that condition. But is 0.5% growth much different? I'm suggesting that it is. For one thing, it is still positive growth. A 40-year period of sustained 0.5% growth would move a country with an initial per capita GDP of \$80,000 to \$97,700. As just indicated, this slower rate of growth is taking place under conditions of prodigious affluence, by any standard. Still, 0.5% strikes the typical person today as unacceptably slow. A world of 0.5% would clearly represent a new era in human values. If we think of 2% per capita GDP growth as the rate that the West has sustained in its transition from an agricultural to an industrial world, and of 4-5% as the catch-up rates that developing countries are driven to achieve in order to attain economic (and political) parity, I'd like to think of 0.5% as the "mature" rate of economic growth, one that an affluent world of economic, political and technological equals can aspire to and sustain over a very long period.

That granted, let's return to the distributive implications. Scenario 3 shows a world in 2150 in which the top 20% of households have gross annual incomes of perhaps \$676,000, while the bottom 20% have income of \$104,000.¹ Is that fair? A household income of \$104,000 is far above the median income of households in the United States today. A household of four can live very comfortably on a stable income of \$104,000; anything above that is luxury. Our advocated 80/20 ratio of 6.5 is about equal to that of France today (6.4), less than that of Denmark or Japan (about 7.0 each) and considerably less than that of the United States (9.8).

Still, people tend to assess well-being by comparing their lots with those in closest physical and social proximity, so the question of fairness remains. I believe that the structure of

¹ These figures are obtained by using the values for 2150 shown in the quantitative summary of conclusions shown on page 26 of the introduction, using as our example a household of four persons.

income distribution shown in Scenario 3 could be experienced as fair under three conditions. One is that the commitment that the distribution will get *no worse* is firm and enforced. This means that a strong societal consensus has been established ensuring that effective policy measures will be taken, if necessary, to guarantee a stable distribution of income. Even more to the point, cultural norms would need to have become deeply internalized in a way that would help preclude the need for policy, in much the same way that cultural norms result in lower levels of compensation for Japanese than for American corporate executives today. Such a commitment would remove a major source of uncertainty concerning the terrain of the economic playing field. The second condition is that our national and global political economies are in fact grounded in social democracy. By this I mean that policies and institutions, perhaps along the lines suggested by Kaus and others in Section II.B.3, would be in effect that strongly limit the social and political consequences of unequal economic resources. And the third condition is that a social ethos develops that lessens the extent to which economic resources and their signifiers are taken as measures of a person's status and worth, perhaps drawing on some of the values expressed by participants in the voluntary simplicity movement surveyed in Section II.C.3.² These three conditions may seem, to some, to be prohibitively difficult to achieve. I believe we'll be motivated to work through these difficulties when the implications of not doing so are thought through.

Our advocated scenario affirms greater global economic integration—globalization—as desirable. I'm persuaded that expanded trade, investment and exchange are likely, on balance, to assist developing countries in attaining the rates of economic growth needed to eliminate poverty and achieve equality with the industrial countries, within the time period of 150 years that is necessary if we are to make a transition to a slow growth world at a level of world GDP still low enough to be ecologically acceptable. This affirmation of globalization is made possible by

² In this regard the values expressed in the responses shown in Boxes IIC-28 and IIC-29 may be particularly germane.

several other assessments, based on our review in Section II.D. One is that nation-states are not likely to disappear as units of political allegiance, accountability and agency, even as the nature of sovereignty evolves to accommodate greater multilateralism. Another is that a social democratic regime of global governance is practicable and realizable. Here I follow Keohane, Robertson, Hirst and Thompson and others. Such a regime would be more layered and diffuse than the national social democratic models of past and recent experience. We have an unsettling period ahead during which the forces of economic integration will likely outpace the establishment of effective institutions of governance and accountability. But the case for coordination is rational, and communication is mostly easy, not difficult. The key uncertainty is not mechanism but commitment. In order for a social democratic regime of global governance to be established and sustained, mass publics will need to share the vision of the human future that it is intended to support and will need to commit to its realization.

The advocated scenario presumes that the human future will be one of pervasive high technological density. As emphasized in Section II.E, I believe the challenges posed by the new technologies are among the most profound we face. These technologies have the potential to dramatically change the way we experience ourselves, our relation to others and our relation to the natural world. Proposals for reversion to a past low-tech order are utopian. I believe a minimal credible stance towards technology has two parts. The first is adoption of a strong precautionary ethic regarding problematic technologies. The second is again the establishment of a social democratic regime of global governance, sufficiently authoritative to regulate the development and use of problematic technologies and to proscribe unacceptable ones.

Is this stance towards technology credible? As we saw in Section II.E.1, many people believe that technological development cannot be constrained in the manner just described. For some this belief has the status of a natural law, rooted in interpretations of thermodynamics, evolutionary psychology, complex systems and the like. Others acknowledge that it is perfectly plausible to imagine that social institutions can constrain technology, but believe that in practice

it will be very difficult to do so, given the numerous diffuse loci of technological innovation, the increasingly individualist values that higher education and economic development appear to encourage, the dynamics of a market economy, the power of corporations and other factors.

I agree with this view—it *will* be very difficult to constrain technological innovation. But that's a far cry from saying that it is impossible. My case for affirming the credibility of social control over technology is straightforward: as the dangers of particular types of new technologies become evident, the benefits of controlling them will be judged to exceed the costs. Of course, such societal decisions won't be based on spread-sheet calculations—they will be the result of political struggle. But if there was widespread agreement that the other particulars of our advocated scenario were desirable and credible, and if it was accepted that the development and use of certain technologies could make that scenario more difficult or even impossible to achieve, then that prior set of agreements in themselves would help change the balance of power in a way that would increase the credibility of the scenario elements that call for social control of technology.

It is necessary to remember that statements to the effect that a particular technological development is inevitable are often tactical moves calculated to demoralize those who find the technology in question to be a cause of concern and who might be motivated to object to it. This move is particularly disturbing because it typically is made by scientific and other elites who are using their authoritative status to intimidate, rather than educate, those with less access to technical information.

All this said, in my judgment there may only be a limited number of technologies of such potentially negative consequentiality that they should be proscribed. As suggested in Section II.E., one rationale for banning a technology would be that its adoption could precipitate large, self-reinforcing and irreversible social and economic inequalities. Another rationale would be that a technology so greatly devalues or compromises human personhood, dignity and autonomy that its adoption would be taken as a signal that our systems of governance are unable to protect

and support this minimal, essential element of civil society. As discussed in Section II.E.1 and II.E.2, I believe that germline genetic engineering and human reproductive cloning have these undesirable qualities and will need to be prohibited. It is likely that additional powerful techniques of genetic manipulation, and the possible development of technologies able to manipulate human cognitive processes in a powerful way, would likewise need to be prohibited.

However, these constrained technologies represent only a small fraction of the total sum of technological innovations that are likely to become feasible over the coming century and beyond. In other words, there is no reason that our advocated scenario need not be full to the brim with many of the sorts of applications described by Coates *et al.*, Kaku and others reviewed in Section II.E.

There are at least two important ways, however, in which our scenario differs from theirs. Whereas the great majority of technological futurists and techno-global neoliberals assume and celebrate an undiminishing pace of innovation and application, our advocated scenario implicitly suggests an increasingly modest technological trajectory. We saw in Section II.A.3 that there is a close, almost definitional, relationship between economic growth and technological innovation. The exuberant economic growth of the past century and the dramatic development of technological power over that same period are two aspects of a roughly single process. In Scenario 3 we gradually bring this exuberant period to a close—first in the high income countries and later in the currently lower income countries—and we usher in a new era of slow aggregate growth, some 100-150 years hence.

Further, whereas the techno-enthusiasts appear to value the increasing power of their technologies as an end in itself, under a social-democratic ethos technologies would be evaluated by the degree to which they help realize a broader set of human development values.

Of course, slower rates of per capita GDP growth do not *necessarily* imply slower rates of technological innovation. Much of the 1970's and 1980's saw high rates of innovation and low rates of economic growth. As we discussed in Section II.A.3, innovation can express itself in

quality improvements or new products that do not show up in the national income accounts as contributions to output. But this is just a ledger-keeping effect. Somewhat more to the point, an innovation needs to diffuse, integrate and mature before it has a noticeable impact on productivity. Still, this is just a lag effect. A true decline in the rate of technological innovation ultimately means a decline in the human, financial and physical capital devoted to this endeavor. But even this slower rate of innovation is positive. Thus, Scenario 3 remains a scenario of increasing technological density.

Who might be unhappy with the advocated scenario?

At the very beginning of this exercise, in Section I.A.2, I described a business-as-usual scenario, Scenario 1, and asked if there were reasons that people might want the world to develop in some other ways. Now I ask the same question about our advocated scenario, Scenario 3.

Who might be unhappy with it, and why?

Techno-global neoliberals

Our advocated scenario was devised in part to refute the claim that there is no alternative to techno-global neoliberalism, so I wouldn't expect that many who subscribe to that scenario would be receptive to this one. In general, neoliberals wouldn't necessarily share the same level of concern about economic inequality or ecological integrity, they are more concerned to protect individual prerogatives than to achieve socially-mediated outcomes, and they tend to trust and welcome the impacts of market-driven technological innovation.

Neoliberals believe that the experience of the past quarter century has largely supported their critique of authoritarian and social democratic political systems, and in some regards they are correct. Neoliberal policies have encouraged strong economic growth in both developing and developed countries, without as yet generating the sorts of horrific negative consequences—economic collapse, ecological catastrophe—predicted by many of their critics.

I believe, however, that techno-global neoliberalism becomes increasingly problematic when its course is projected much beyond another 25 years or so. Inequality among countries declines only minimally, institutions of governance erode, norms of corporate culture permeate and condition the larger society, and technologies of unprecedented manipulative power continue to proliferate. If this scenario prevails, well before the mid-century mark neoliberal professionals in the most affluent countries will likely have begun modifying their children's genes to give them, as Daniel Koshland puts it, "a better chance of success."

I believe this trajectory ends in catastrophe. As discussed in Section II.E.2, I can't see how the conditions that enable any society to function cohesively can be maintained when the affluent techno-elite become fixated on the idea of genetically engineering themselves and their children into a superior sub-species.

In short, if we desire stable, equitable and ecologically benign economic growth, and technologies that support rather than undermine human well-being, we will want more rather than less social governance. Techno-global neoliberalism may serve a useful role for a bit longer as countries make transitions to modern market economies, but it is not the governance regime of choice for a mature global society.

If truth be told, prudent neoliberals should find much in our advocated Scenario 3 that should give them reason to re-evaluate their opposition to it. After all, it calls for continuing positive economic growth for at least the next 150 years; a generally positive assessment of technological innovation, with prohibitions advocated for only a few markedly destabilizing technologies, and for the distribution of incomes to be determined largely by market forces, albeit with the proviso that inequality does not exceed agreed-upon bounds. Box IB-16 illustrates the possibility of a neo-liberal/social-democratic partnership, perhaps in support of quantitative Scenario 2.

Environmentalists

Some environmentalists, particularly those deeply committed to visions of Green sustainability, might be unhappy with Scenario 3. They might believe that a level of energy use in 2150 five times today's level, even if fixed at that point, is far too high. They might also believe that a level of global per capita GDP *seventeen times* today's level (\$82,000 in 2150 vs. \$4,900 in 2000), no matter how artfully crafted, cannot help but be more destructive of ecological systems than is acceptable.

They might also object that even if the growth trajectory I show for the next 150 years is achievable in an ecologically benign manner, and even if a level of energy use of 60 terawatts is in fact sustainable indefinitely, the fact that I show output continuing to grow from that point on, even at the low rate of 0.5% a year, means that Scenario 3 is, ultimately, not sustainable much past 2150. An additional century of 0.5% output growth generates total output 65% greater than its level in 2150. Three centuries of 0.5% growth puts output at more than quadruple its 2150 level. To claim that these levels of higher output can be achieved using a constant rate of throughput is simply disingenuous—to do so is to invoke the “angelic GDP” so well refuted by Herman Daly, and by common sense. Eventually, this argument goes, we will need to learn to live in a world of zero output growth as well as zero growth in resource inputs. The only alternative would be to bio-engineer ourselves into nanotech life-forms that use solar energy to omnivorously incorporate all available matter into commodities or offspring, and to colonize three-dimensional space in this manner throughout the solar system and beyond.

These are important criticisms, and my response has several parts. First, the high level of output generated under Scenario 3 is credible only because resource limits do not appear to be significant constraints on economic growth over the relevant time horizon. I began this exercise fully expecting that among the least problematic topics I would need to deal with would be that of documenting the existence of resource limits to economic growth. I was surprised to find out how difficult that was. It's true that biogeophysical constraints, configuration-dependent limits to

productivity improvement, and the growth of complexity can all impose increasing costs on marginal units of output that, if conditions remained unchanged, would bring an end to economic growth. The critical question then becomes: can technological innovations (of the configurational sort, in Ayers' terminology) more than offset these increasing costs? There is no way to answer this question analytically, but I believe the material reviewed in Sections II.A.3 and II.E.1 gives good reasons to suspect that the process of technological innovation is very far from exhausting its potential.

The world in 2150 under the advocated scenario might be characterized as one of “high output, low growth.” Most people, including those involved in the growth-environment-equity discourse, tend to associate high output with *high* growth, and low output with *low* growth. Part of the challenge that the advocated scenario presents for many environmentalists is that it argues that in order to create the conditions of economic equality that will enable a globally sustainable (i.e., slow) growth regime to be negotiated, we must first pass through an extended period of high growth.

In my opinion the major environmental challenges of the next decades are going to focus increasingly less on the issues of the period just past—clean air, clean water, preservation of wild places, and the like. While there is much left to do to complete this late 20th century environmental agenda, to a great extent we know what needs to be done, and public opinion is generally sympathetic. The new challenge we face is: how deeply and in what ways do we want to transform the workings of the natural world through technology? Where do we draw the lines? And how do we enforce these?

The call in Scenario 3 for a social democratic/internationalist regime of global governance should be of critical interest for those concerned about environmental protection. Without a political system of this sort, it's difficult to see how the sorts of global policies needed to ensure environmental protection in the face of continued growth could be devised and

implemented. This applies to both the conventional roster of environmentalist concerns and even more so to the new set of concerns that the new, deeply manipulative technologies pose.

All together, I believe that Scenario 3 is both pro-actively Green, and about as Green as can be advocated and still be at all credible. For the industrialized world to reduce its rates of economic growth to 0.5% per year over the next 50 years will require as close to a true social, political and economic revolution as democracies are probably capable of. The good news is that we have 50 years over which to do this. The bad news is that we have *only* 50 years. Children in elementary school today will be running the world in 50 years. Within the next 10 years these children will begin committing themselves to values that will structure their life choices, and once set these tend to resist change. It is difficult to see how Scenario 3 can succeed without strongly incorporating and nurturing values of the sort associated with Green, environmentalist, and voluntary simplicity sensibilities. Box IB-16 illustrates the possibility of social-democratic/Green sustainability partnerships in support of quantitative Scenarios 3, 4 or 5.

But what about the charge that in constructing Scenario 3 I've avoided confronting the inevitability of output limits to growth, and the social and political challenge that limits present, simply by declaring by fiat that world output can continue to grow at 0.5% after 2150, even as available resources remain constant?

In Section II.B.3.d I was critical of environmentalists who call for a near-term transition to a world of steady-state resource flows, but who then casually declare that economic growth can nonetheless continue at a healthy rate as a result of efficiency-enhancing technological change. Now it appears that I've done something similar, with the difference that instead of calling for this questionable situation in the near term, at existing levels of output, I call for it to begin in 2150, at dramatically higher levels of output. Is this really any different? Do I really believe that economic output can continue to grow, even at the low rate of 0.5%, indefinitely after 2150, while energy use remains constant at 60 terawatts? I believe I made a credible case in Section II.A.2 that a level of output consistent with a 60 terawatt world is in fact sustainable indefinitely, even in

the absence of further significant technological innovation. But if I believe in addition that output growth can continue, indefinitely, under that resource constraint, then I should say so, and give good reasons for that belief. If not, I should say how long I believe output can grow until we will be forced to make the transition to a zero-growth world. And in *that* case, I would need to explain how I believe output should be distributed. Remember, one important reason for rejecting the zero-growth Scenario 5 in favor of the slow-growth Scenario 3 was that I could not imagine how any degree of income inequality much beyond an 80/20 ratio of 2.5 to 1 could be justified under the former. So what's going on?

The unresolved tension

Some years ago a friend confided that despite his best efforts, he couldn't imagine a credible, desirable future. Economic growth could likely continue for many decades, but could it continue for centuries? Or millennia? He couldn't see how. On the other hand, he couldn't imagine how a no-growth world could be structured on anything other than some sort of caste, feudal or authoritarian basis. He saw these choices as categorically exhausting the options: either we grow forever, or we don't. This first is difficult to believe, and the second is difficult to like.

The new techno-utopians offer a third option, or rather, a scenario that makes the first option at least arguably credible. We can continue to grow—forever—by continually reworking a fixed resource base into successively more deeply manipulated artifacts. But as argued in Section II.E.1, in short order this process begins to generate artifacts with much the same qualities as living systems, and living systems with the qualities of artifacts. For me, this is also difficult to feel good about.

Scenario 3 ends in 2150 with a high, more equitably distributed level of output, a fixed level of energy use, and output growth continuing at the slow rate of 0.5% annually. What happens after that?

The honest answer is: I don't know. It's likely that we could continue growing at 0.5%, with fixed resource use, for a long time. But for centuries? Or millennia? At some point we would encounter limits, and would have to begin a transition to a 0.0% world. Unless, of course, we chose the techno-utopian route. Nothing in the preceding 628 pages of this exercise offers any insight into means by which humankind might be able to avoid having to choose, someday, between what appear to be two or three very problematic futures.

Given these unresolved questions, how do I justify Scenario 3?

Scenario 3 gets us to a point that is both desirable in itself, and that will make it easier for us to negotiate the subsequent transitions, whatever they might be. Scenario 3 gets us economic and political equality among countries, a fair distribution of income among people, a high level of material well-being and technological competence, an indefinitely sustainable level of energy and resource throughput, and a political structure that allows protection of environmental and other public goods and control over dangerous technologies. By affirming a global ethos of moderation and precaution concerning economic growth and technology, Scenario 3 leaves more options available for our subsequent future. By affirming egalitarian and democratic values, it helps ensure that more people will have an equal say in what happens next, thus helping assure legitimacy and stability. If our descendants choose to move towards a zero-growth world, they will be doing so after already having learned how to live together in a very slow-growth world. If they choose a future of continued technological transformation and growth, they will be doing so after already having learned how to control certain particularly dangerous and destabilizing technologies.

Final queries

For all this, it's still fair to ask if I really believe that it's meaningful to specify quantitative goals for, say, per capita GDP of persons in the top 20% of households in China in 2150. A first-order answer is yes. At the beginning of this study I made a commitment to pursue

each critical topic until I felt I could give a full and honest response. Without such a commitment the study would not have been worth doing. I do believe that Scenario 3 can be realized, as described, if enough people agree that it represents a future they are willing to work to make happen. Further, I believe that it is compelling enough that sufficient numbers of people would indeed be able to come to that agreement, after having considered all the alternatives. I don't believe it is a utopian scenario. There will be a world in 2150, and it will look like something, and what it will look like will largely be the result of actions, big and small, that people decide to take. The existence of a credible scenario that large numbers of people find compelling increases the likelihood that the future will look more like that scenario, than like something else.

But there are second-order answers as well. Many aspects of the scenario, especially the quantitative aspects of the later decades, might be thought of as metaphors rather than as concrete policy goals. The high values given for per capita incomes in 2100 or 2150, for example, could certainly come to pass. But they might also be thought of as metaphors for the degree of technological density that would characterize the world of that period.

A further, and more telling, second-order answer has to do with the fact that the whole purpose of talking about goals for 150 years from now is to motivate actions that each of us will take today. We can all regard the quantitative values shown for 2150 with many grains of salt, yet still act, with a fuzzy sense of greater confidence, in ways that we might not have otherwise, had we not worked through the details of the construction of Scenario 3.

So what does Scenario 3 invite us to do *today*? I'd like to think that it invites us to:

- * celebrate moderation of consumption, being clear that there is room for all to grow, if the well-off learn to grow slowly;
- * commit to ensuring that economic inequality in the developed countries does not increase beyond its current levels;
- * continue and deepen our commitment to ecological integrity as a global imperative;
- * affirm the development of technology in the service of society, and have the wisdom and strength to forego technologies of dehumanization and division;
- * support the establishment of accountable institutions of global governance; and

* affirm human agency, and the ability of people to cooperate towards a desired common future.

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EPILOGUE 2004

As noted in the introduction, research and writing for the dissertation upon which this exercise is based was largely completed by early 2000 and remained on hold until summer 2003. At that time I began preparing the dissertation for submission. It was accepted in May 2004. Has anything happened during the hiatus or since that would require its presentation or conclusions to be revised? To the best of my knowledge, I don't believe so. Is the advocated scenario still credible and compelling? I believe it is.

Aggregate economic inequality has continued to increase in some countries and decrease in others, but not by great amounts either way. In many countries the income shares received by those few in the very highest income percentiles continues to grow dramatically. The depletion and degradation of natural resources continues to raise concern and demand attention, but there is still no clear indication that these impacts are likely to be severe enough to compel, over the period of the exercise scenarios, an end to economic growth. Recent trends in climate change are increasingly recognized as being anthropogenic and deserving of abatement action, but no truly catastrophic risks have yet been shown to be likely. Environmental values remain an important thought not quite first tier set of motivating values on the world stage. Concern that the post-1975 productivity slowdown might represent an exhaustion of innovative potential has greatly lessened in the face of strong post-1995 productivity gains. Concerns over the impacts of globalization have increased and are fueling continued demands for responsible global governance. Despite the crash of technology sector investments in 2000, support by much of the public for high technology in general as a driving force of the human future continues to be strong. However,

controversy has increased concerning many applications of biotechnology and proposed applications of nanotechnology. It remains uncertain if these will come to be perceived as uniquely dangerous threshold technologies that need to be proscribed, or as defining technologies of a new human epoch.³

In my judgment, these developments tend to validate or reinforce the arguments put forth in the dissertation as it stands. .

What about the events of September 11, 2001, and their aftermath? I gave little explicit attention in the dissertation to issues of international conflict and national security. I believe I would have been able to make a case that the values, policies and institutions that support quantitative Scenario 3 and the narrative scenario of social democratic internationalism would encourage a reduction in international conflict, and would enable such conflict as occurs to be successfully managed. But the case still remains to be made.

The dissertation might be faulted for seeming to put its faith in a naïve understanding of human nature. At points it reads as though the advocated scenario is to be agreed upon by global acclamation, without serious dispute or rancor. I considered including a section addressing the contending beliefs about the nature of human nature and their implications for the various scenarios. But I left the dissertation as it was, for two reasons. One was that it was already very

³ For current inequality trends see the *World Development Report, 2001/2002*, published by the United Nations Development Program (2002). For reports on availability of energy resources, see *World Energy Outlook 2002* by the International Energy Agency (2002). For recent reviews of the potential impacts of climate change, see the *Third Assessment Report – Climate Change 2001* by the Intergovernmental Panel on Climate Change (2001). For the current state of the sustainability discourse see the *Report of the World Summit on Sustainable Development* (2002). See also the annual editions of the *State of the World Report* published by the Worldwatch Institute. For new projections of productivity gains see Jorgenson et al. (2003). For an analysis of the new productivity gains see Nordhaus (2001). For the current state of the globalization discourse see the reports from the 2004 World Social Forum, held in Mumbai, India: www.wsfindia.org. For current thinking on science, technology and society, see reports from the March 2002 conference, *Living with the Genie: Governing the Scientific and Technological Transformation of Society*: www.livingwiththegenie.org. For background on concerns about nanotechnology see *The Big Down: Atomtech Technologies Converging at the Nano Scale*, published by the ETC group (2003). For an overview of concerns about the new human genetic technologies see *The Threshold Challenge of the New Human Genetic Technologies* (2002), available on the website of the Center for Genetics and Society: www.genetics-and-society.org.

long. The other was that, in the final analysis, no theory of human nature relieves any of us of the need to make choices. The fundamental social question is, “What kind of world do we want to help make happen?” As it stands, this exercise offers one answer.