



A Monthly e-Newsletter From:

 Institute for Alternative Futures

February 2008

In This Issue

[High Tech Energy Scenario Offers a Sustainable Future](#)

[Favorable Trends Fuel Solar Power Promise](#)

[2019: Health care that Works for All Will Define Options for Change Agents](#)

[IAF Welcomes Stephanie Stevens to the DRA Project](#)

[IAF President Jonathan Peck Discusses Strategies for Pharma 2029](#)

Forward Perspectives

High Tech Energy Scenario Offers a Sustainable Future

By IAF Senior Fellow [Bob Olson](#) and IAF Futurist [Craig Bettles](#)

If we are to avoid the potentially disastrous scenario many describe as our "official energy future", we will have to exploit all the opportunities a High Tech Energy Scenario might offer.

IAF explored the "official energy future" in an [Alternate Peak Oil Scenario](#). The Alternate Peak Oil Scenario involves obtaining more and more oil from increasing distant, environmentally fragile and politically problematic areas. Using more and more oil (and coal, without carbon sequestration) would drive us over the cliff of catastrophic climate change.

Improving energy efficiency is the centerpiece of the High Tech Energy Scenario. It involves a sweeping transformation of all our technologies that use energy - virtually our entire technological infrastructure - to "do more with less." Studies over the past 30 years have demonstrated that improving the efficiency of cars and trucks, buildings, and industrial processes is less costly over time than buying more and more energy from any current source. A recent study by the McKinsey Global Institute estimates that improving [energy productivity](#) can [cut energy demand by half](#) using proven technologies.

A second element in a High Tech scenario is significant investment in the efficiency and cost of alternative sources of energy. Only [13% of the world's primary energy](#) comes from renewable resources and much of that energy comes from the traditional burning of biomass like wood. Modern technologies like geothermal, wind, solar, and marine energy together

produce less than 1% of the world's energy. An Apollo Project-like strategy is needed to accelerate the development and diffusion of these technologies.

The blackout of the Northeastern United States in 2003 shed light on a third element of needed change, modernizing our antiquated energy grid. Tomorrow's energy grid needs to be a "smart grid" that is self-healing and able to route energy efficiently from small, distributed power generators like rooftop solar panels, wind turbines and fuel cells. Developing a smart grid will require a new partnership between utilities and the government where the risks and rewards of a new grid are shared equitably between the producers and consumers of power.

The High Tech Energy Scenario draws on the leading edge scientific knowledge and emerging developments in technology. Consider some of the work already underway in just one area of technology, nanomaterials, applied to just one element of the energy future, improving energy efficiency. If energy efficiency can easily be doubled using proven technologies, what will be possible as technologies like these become widespread?

- **Super-strong lightweight materials** - Magnesium alloys and carbon fiber matrix composites incorporating nano-sized particles for vehicle bodies stronger than steel but 50% lighter
- **Solid state lighting** - Lighting using semi-conductor diodes that uses 1/10th the energy of incandescent lighting
- **Smart roofs** - Nano-based optical structures and temperature-sensitive polymers that change the reflectance of roof materials to reflect solar radiation in summer and absorb it in winter
- **Self-optimizing sensor systems** - Nano-based micro-sensors for more flexible control and optimization of everything from small electric motors to large buildings and industrial energy systems
- **Quantum wire** - Wire for power grids that is one-fourth the weight of copper wire and has almost no electrical resistance

Research is underway using nanomaterials for many other areas related to energy such as hydrogen storage, nanostructured solar cells, thermochemical catalysts for extracting hydrogen from water at moderate temperatures, and a revolutionary improvement in battery technologies based on ultracapacitors that utilize nanotubes for high surface area, enabling near instantaneous charging and no degradation.

With equally impressive developments underway in biotechnology and information technology reinforcing and accelerating these developments, we get a picture of possibilities ahead for a very different energy future than the one we have been pursuing. First we have to abandon the assumption that we already have an advanced technology, and move rapidly to replace the inefficient, depleting, dirty technologies of the 20th century with far more advanced 21st century technologies that will make environmental sustainability our preferred energy future.

Favorable Trends Fuel Solar Power Promise

By IAF Intern Tyler Ruthven

Global total photovoltaic capacity has gone from [1.4 GW\(p\) in 2000 to 12.4 GW\(p\) in 2006.](#) IAF forecasts that the industry will continue its rapid growth due to several powerful societal, economic, and technological trends.

Solar technology is rapidly advancing and expanding. Both photovoltaics and solar thermal

technologies are undergoing a revolution of innovation that is driving down costs, raising efficiency, and increasing the portfolio of technologies that are tackling our energy problems. Photovoltaic technologies, which turn light directly into electricity, have expanded from the decades-old mono and multi-crystalline silicon systems to cheaper and less resource intensive systems using new technologies like [amorphous silicon](#), [CdTe](#), [CIGS](#), and [quantum dots](#). Solar thermal technologies, which turn light into heat, have expanded from the simple solar trough design to modified systems that allow power producers to [store power overnight](#), rendering obsolete solar power's greatest drawback. These technologies are quickly moving out of the laboratories and into the commercial market where economies of scale will reduce prices even more.

Technological trends that are not solar specific will also profoundly affect the competitiveness of solar power. Storage technologies from batteries to underground pumped air are rapidly advancing, serving to reduce the intermittency of solar power. As plug-in hybrid electric vehicles (PHEVs - vehicles that can be charged from a plug in addition to gasoline) become commercially viable, solar will no longer just be competing with coal, nuclear, and natural gas, but will also have the ability to directly displace American oil imports.

The economic trends have in many ways been more impressive than the technological trends. While the price of silicon (which makes up around [45% of the price of a conventional solar cell](#)) has skyrocketed from around [9\\$/kg](#) to over [350\\$/kg](#) on the spot market in the past 7 years, the price of a solar panel per Watt has only increased 50 cents (to [\\$4.70/W](#)) from its lowest point. What this means is that producers have become much better at efficiently using silicon. However, this silicon shortage is expected to greatly ease as new silicon plants come online in the next couple years which will lead to a great reduction in the \$/W of solar panels.

Other economic trends are just as assuring. Companies like [First Solar](#) and [Q-Cells](#) have seen their stock prices and profits soar in 2007 and private companies like [Nanosolar](#) and [Ausra](#) are attracting massive amounts of [venture capital](#). With a growth rate of over [35%](#) for the solar industry in the last few years and with rising oil and natural gas prices it is easy to understand why.

Finally, the societal realization of the dangers of climate change and energy insecurity is forcing national and local political action in support of a sustainable framework in which solar and other renewable technologies will succeed. American states all across the country are passing [Renewable Energy Standards](#), mandating that a certain percentage of the state's electricity must come from renewable sources. This has been a boon to the solar industry particularly in the sun-drenched American southwest where solar power is already near-competitive with natural gas, the main peak power producer that it will displace. Every week is bringing news of a [new solar power contract](#) being signed in California or Florida. In addition to state and federal tax credits for solar technologies, federal climate change legislation will further increase the attractive nature of solar power as the environmental externalities of fossil fuels are priced into the cost.

Specific predictions of solar power's place in the energy make-up still vary widely. [Scientific American](#) recently published a plan by several renewable energy scientists stating that if the U.S. invested \$500 billion over the next 40 years solar power could provide 69% of the nation's electricity. The [European Photovoltaics Industry Association and Greenpeace](#) have forecast that with a feed-in tariff of the type used in Germany and an increased promotion of efficiency technologies, photovoltaics alone (not including solar thermal) could comprise 9% of the world electricity supply by 2030 and 28% by 2040. Both of these forecasts are optimistic on the

policy front but they are also underestimating the technological front. Both studies are based on conservative increases in the solar technologies and conservative estimates have been wildly wrong in the past ten years. They likely will be in the future as well.

Significant hurdles still remain. Storage technologies need to be demonstrated, production needs to be simplified, and efficiency needs to be increased. But with the portfolio of different technologies attacking these problems and with the financial, governmental, and social support these companies are receiving, the future of solar power is bright.

J. Tyler Ruthven is currently pursuing a Master's in International Science and Technology Policy at George Washington University. Ruthven is currently assisting IAF on projects for the Transportation Security Administration and the American Society of Mechanical Engineers.

News and Events

2019: Health care that Works for All Will Define Options for Change Agents

IAF is looking forward to the next U.S. president with a forecasting project to guide those who will transform health care with clear and compelling descriptions of a system that works for all. Over the next year IAF will publish a series of papers addressing nine key transformations.

- **Goals and values for health care** - IAF will identify key endpoints to guide transformations and the unchanging agreements that bound change in a social contract that all parties understand.
- **Political change** - IAF will explore the ideologies, realignments and key constituencies that will work through various government entities.
- **Policy** - IAF will forecast the regulatory changes for health care professions, new drugs and technologies, reimbursement and the information infrastructures for care.
- **Science and technology** - IAF will describe what will be available from imaging, nanotechnology, biomonitors, vaccines, stem cells, genomics/proteomics, psychology and health services research.
- **Delivery systems** - IAF will characterize care offered in medical homes, concierge settings, hospice, hospitals, specialty care and nursing homes along with public health and mental health care.
- **Payment systems** - IAF will identify how public, private and mixed payments will flow so that the responsibilities of different parties are defined with optimum incentives as we evolve from legacy systems into new procedures and agreements.
- **Infrastructure** - IAF will show the changes in bricks & mortar, electronic networks, workforce, standard setting bodies and funding forms that will enable the evolution of care.
- **Health care economics** - IAF will provide a classic stakeholder analysis while illuminating the economics of prevention and behavioral economics along with descriptions of who pays for innovation, disease and disability.
- **Social & economic conditions** - IAF will forecast the social and economic conditions that will drive change in health care.

Each paper will offer forecasts showing what will work, what the cost of failure could be, and what has to change to achieve health care that works for all. This view on the future of health care will be placed into the context of the larger changes in society that informs all IAF work.

Whether it is climate change, the energy crisis, a push for social justice or ongoing war, we will continue to relate health care to the changing landscape for a big picture view of what is ahead.

[IAF Welcomes Stephanie Stevens to the DRA Project](#)

IAF is continuing its commitment to developing talented future oriented thinkers through internships. In February, IAF added Stephanie Stevens to its roster of interns. Stevens will be working with IAF Founder and Chairman of the Board Clem Bezold as part of the [DRA Project](#). The DRA Project is IAF's multi-year, multi-stakeholder project to identify the most promising advances for bringing health gains to the poor and underserved and accelerate the development and deployment of those advances to reduce disparities.

Stevens is pursuing her Master's degree in Public Health and is expected to graduate from the University of Maryland at College Park in May 2008. She is a graduate of Longwood College with a major in Communications Studies. She also works at the University of Maryland Health Center in outreach and communications in addition to her interning with IAF. Throughout her education, Stevens has shown a focus and interest on issues related to diversity and disparities.

[IAF President Jonathan Peck Discusses Strategies for Pharma 2029](#)

IAF President Jonathan Peck has just published a new article that states clearly what he sees as the major challenge facing pharma leaders today. While not surprising for those who read the [Pharma 2029 Report](#), Peck offers a clear warning that companies risk losing what they need most to deal with coming changes in health care. The article is published in The RPM Report and is available by clicking [here](#). Registration is required, which gets you to the article and a free month of access to The RPM Report articles on the FDA, CMS and pharma industry.

[back to top](#) | [about](#) | [methods](#) | [IAF futurists](#) | [search](#) | [news & events](#)

Institute for Alternative Futures, 100 North Pitt Street, Alexandria, Virginia 22314
(703) 684-5880 Fax (703) 684-0640 [✉ Map to IAF](#)
© Copyright 1998-2003 Institute for Alternative Futures

Alternative Futures is a monthly production of The Institute for Alternative Futures.

powered by **emma**