The Global Economic Imperative of the Efficiency of Everything *

John A. “Skip” Laitner

In Conversation with Participants of the ACEEE First Intelligent Efficiency Conference

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Some Opening Perspectives

• The productivity benefits from what my colleague Jeremy Rifkin calls “Second Industrial Revolution” technologies are diminishing.

• My own research indicates, and the evidence clearly suggests, that among the biggest reasons for those diminishing returns is the inefficient use of resources – and especially the inefficient use of energy.

• A social and economic transformation is clearly needed to sustain the national and international economies – driven both by purposeful effort and targeted investments which drive large-scale upgrades in energy efficiency.

• ICT-enabled services (intelligent efficiency) is the critical link between today’s economy and tomorrow’s future.
The Quick Roadmap Ahead

• We have (especially over the long haul) the problem of a lagging economy
• There is a critical need to understand energy as work, rather than energy as commodities sold that are sold on the market
• Beyond energy is the huge problem of the inefficient use of capital
• The good news is that ICT-enabled services can become the catalyst to build a more robust, resilient, and sustainable economy
Lagging Trend in the Global Economy’s Productivity

Annual Global Productivity Growth Trends 1996-2060

The inefficient use of resources, and especially energy, constrains a more robust future economic activity.

Source: OECD Economic Outlook May 2014 - Long-term baseline projections
Two Views on Energy

- Energy as a commodity tracked by agencies like the U.S. Energy Information Administration and the International Energy Agency; or
- Energy as the capacity to do useful work.
- **Comment:** To ensure the appropriate development of innovation that catalyzes sustainable economic activity, the emphasis needs to be on energy as work.
Energy as Work

Energy = Exergy + Anergy = Constant
Source: Kümmel (2011)

Work = Exergy * Efficiency
Source: Ayres and Warr (2009), and Laitner (2013, 2014)
Exploring the Difference Between Energy, Exergy, and Work

Source: Laitner 2014 Available on Request

Economic and Human Dimensions Research Associates ::::...
86% of energy is wasted in us

With a similar magnitude of inefficiency at the global level

Source: Laitner
http://www.aceee.org/blog/2013/08/thinking-big-about-energy-efficiency
The Lagging Efficiency of Capital

• While we clearly need to focus more heavily on significantly greater rates of Energy Efficiency improvement, we cannot afford to neglect our efficiency of our infrastructure. . . .

• Consider the following three indicators:
  — The nation’s electric utility grid? ~50% capacity
  — Our highways at peak? ~5% capacity
  — Data server utilization? ~5 to 15% utilization

• If we are to emphasize real momentum in moving toward sustainability, the average efficiency of all capital should be nudged above 90%
A Working Hypothesis of the Economy-Wide Impact of the Network Effect


Economic and Human Dimensions Research Associates ::::...
A Thought Experiment: ICT’s Potential $600 Billion Boost to U.S. GDP in 2013

With the further benefit of a 1.1 Billion Barrel Energy Efficiency Gain Driving a $79 Billion Energy Savings

Continuing the Thought Experiment: ICT’s Potential to Global GDP in 2013

<table>
<thead>
<tr>
<th>Region</th>
<th>Potential GDP in 2013 ($ Billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>600</td>
</tr>
<tr>
<td>OECD Nations</td>
<td>1,888</td>
</tr>
<tr>
<td>Non-OECD Nations</td>
<td>1,053</td>
</tr>
<tr>
<td>World</td>
<td>2,940</td>
</tr>
</tbody>
</table>

Typical Annual Expenditures 2013, with program expenditures and ICT-related investments beginning in ~1998:

- Reference Case Cost of Energy Services Today: $1,392
- Policy and Program Expenses: $2
- Energy Efficiency/Renewable Energy Investments: $16
- Energy Bill Savings: -$94
- Net Costs of Energy Services: $1,313

Driving a Net Gain of 8.2 MM Jobs, a $600 Billion Gain in GDP, and Creating a More Secure and Resilient Economy.
Intelligent Efficiency?

Offering just two of so many different examples. . . If we’re willing to really look!
Optimizing our Nation’s Traffic Signals

- There are an estimated 300,000 traffic signal systems throughout our country today.
- Stop and start driving and poorly timed signals cause unnecessary fuel consumption on our nation’s highways.
- Retrofitting these systems with smart sensors and dynamic programming techniques can improve traffic flow so that we reduce our highway fuel consumption 5-10% per year.
- The cost? About $10-12 per household. The savings? About $150 per household per year – and possibly more!
Developing Intelligent Industrial Efficiency

- With new information technologies and advanced sensors and controls, for example. . .
- Both Schneider Electric and Rockwell Automation, but also others. . .
- Offer services to manufacturing firms that can reduce electricity use by up to 40 percent and reduce oil and gas requirements by up to 35 percent.
Perhaps Our Ultimate Economic and Intelligent Efficiency Resource?

• Recalling the comment of early Twentieth Century UK essayist, Lionel Strachey, who remarked: “Americans guess because they are in too great a hurry to think.”

• Jerry Hirschberg, founder and former CEO of Nissan Design, who noted that: “Creativity is not an escape from disciplined thinking. It is an escape with disciplined thinking.”

• And Henry Ford once said, “Thinking is the hardest work there is which is the probable reason why so few engage in it.”
The difficulty lies not with the new ideas, but in escaping the old ones. . . .

John Maynard Keynes
THE DIFFICULTY IS TO ESCAPE THE OLD IDEAS
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And again, look for our new report: