Energy Efficiency for Economic Development: Markets and Multiple Benefits

5th International Forum on Energy for Sustainable Development
Tunis 4-6 November 2014
2 recent IEA reports
What’s new in EEMR 2014?

- More robust market evaluation methods
- Expanded analysis from 11 to 18 countries
- New decomposition methodology
- More energy efficiency indicators
- Focus on transport and finance
Global Energy Efficiency Market

IEA produced a series of new market estimates:

a) Capital Formation
b) Global Energy Intensity
c) Modelled energy efficiency based on productivity change (LIEF – long term industrial forecasts)
d) Monte Carlo (adjusted from LIEF)
e) Financing leveraging
Global Energy Efficiency Market

- Estimated to be between USD 310-360 billion
- Energy consumers investing in new, more efficient energy consuming stock and practices
- Signals point to further growth

Monte Carlo: Distribution of energy efficiency market estimation
Energy efficiency: still the ‘first fuel’

EE supplied (1336 Mtoe) more in 2011 to meet energy service demand than oil (1200 Mtoe), electricity (552 Mtoe), natural gas (509 Mtoe) in IEA-11*

Total final consumption of fuels and energy savings from energy efficiency in 11 IEA countries in 2011

*IEA-11: Australia, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Sweden, United Kingdom, United States
EE: an invisible power-house

Energy efficiency savings in IEA-11 countries rival TFC of major energy consuming countries and regions (e.g., EE improvements over the last 4 decades saved more energy in 2011 than TFC in EU)
Factors affecting energy demand over time

Energy efficiency has been the prime mover to reduce energy demand (TFC) in IEA 18*

Decomposition of Total Final Consumption by factor and isolated impact of each factor on energy demand (compared to 2001)

*IEA-18: Australia, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Sweden, United Kingdom, United States + Austria, Canada, Czech Republic, Korea, New Zealand, Spain, Switzerland.
EE: decoupling economic growth from energy consumption

In 12 of 18 IEA countries, EE improvements were greater than growth, resulting in net decrease in TFC
Transport: EE market driven by VFE standards

- Vehicle fuel economy standards (VFE) affect 70% of global new vehicle fleet (50 million vehicles in 2011)
- Standards could achieve between USD 40 and 190 billion in fuel savings by 2020 pending ambition and effectiveness

Enacted fuel economy standards for personal vehicles

Source: Global fuel economy initiative
Transport: large potential in modal ‘shift’

- Transport EE improves with modal shifts (e.g., rail/bus from less efficient PLDVs)
- Involves large investments in infrastructure: global spending on rail/bus infrastructure USD 195 billion in 2010
- Area of increasing focus in both OECD and non-OECD

Energy consumption per passenger or tonne kilometre by mode

Source: Energy Technology Perspectives, IEA
Transport: a shift in geography

All new transport demand estimated to come from non-OECD: source for demand translates into EE market opportunity

Source: Energy Technology Perspectives, IEA
Energy efficiency finance

- Energy efficiency finance is expanding and innovating
- Third-party financing estimated in range of USD 120 billion
- Bilateral and multilateral development funding for energy efficiency was over USD 22 billion in 2012
- Energy efficiency finance is moving from niche to established financial market segment
- Energy efficiency market will grow with greater transparency and standards for financial products
# Energy Performance Contracting

Market size in selected countries

ESCOs: a USD 30 billion market globally, and growing

<table>
<thead>
<tr>
<th>Country</th>
<th>Estimated market size (USD)</th>
<th>Number of ESCOs or projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>12 billion</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>6.50 billion</td>
<td>&gt; 500 projects</td>
</tr>
<tr>
<td>Germany</td>
<td>4.5 billion</td>
<td>500-550 ESCOs</td>
</tr>
<tr>
<td>France</td>
<td>4.3 billion</td>
<td>350 ESCOs</td>
</tr>
<tr>
<td>Italy</td>
<td>670 million</td>
<td>50-100 ESCOs</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>540 million</td>
<td>30-50 ESCOs</td>
</tr>
<tr>
<td>Spain</td>
<td>450 million</td>
<td>20-60 ESCOs</td>
</tr>
<tr>
<td>Canada</td>
<td>420 million</td>
<td></td>
</tr>
<tr>
<td>Korea</td>
<td>330 million</td>
<td>&gt; 1 400 projects</td>
</tr>
<tr>
<td>Denmark</td>
<td>195 million</td>
<td>15-20 ESCOs</td>
</tr>
<tr>
<td>Croatia</td>
<td>140 million</td>
<td>10 ESCOs</td>
</tr>
<tr>
<td>Russia</td>
<td>140 million</td>
<td>30-100 ESCOs</td>
</tr>
<tr>
<td>Ukraine</td>
<td>140 million</td>
<td>30 ESCOs</td>
</tr>
<tr>
<td>Japan</td>
<td>140 million</td>
<td>50 projects</td>
</tr>
<tr>
<td>Total</td>
<td>30 Billion</td>
<td>&gt;1100 ESCOs</td>
</tr>
</tbody>
</table>

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Country case studies

- 11 countries:

  - Canada
  - China
  - EU
  - India
  - Indonesia
  - Ireland
  - Italy
  - Japan
  - Korea
  - The Netherlands
  - Thailand

- Highlighted sub-markets and innovative policies harnessing market factors
China: increasing investments in EE from 11th to 12th Five-Year Plan

- **11th FYP**: Invested USD 120 billion between 2006-2010 to achieve between 238-287 Mtoe of energy savings
- **12th FYP**: Target of USD 200-270 billion in efficiency investments between 2011-15 to achieve 235-268 Mtoe
- Change in ‘return’ may reflect
  - (i) easy wins in industry previously captured and
  - (ii) shift to more capacity building investments

<table>
<thead>
<tr>
<th></th>
<th>Energy savings</th>
<th>Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total (Mtoe)</td>
<td>Savings achieved by energy efficiency (Mtoe)</td>
</tr>
<tr>
<td>11th FYP actual</td>
<td>441</td>
<td>238-287</td>
</tr>
<tr>
<td>12th FYP needed</td>
<td>469</td>
<td>235-268</td>
</tr>
</tbody>
</table>
European Union showing progress and stepping up ambition

- EU has reduced energy intensity by 28 percent since 1990
- Doubling of European Commission-sponsored energy efficiency finance to over EUR 10 billion

Energy Intensity of Selected Countries and Regions

- Canada
- United States
- Australia
- EU-28
- Japan
Asia: Growing EE lighting markets

- LED market taking off in Asia:
  - Thai LED sales have grown exponentially from USD 2 million in 2007 to 38 million in 2013
  - In Japan LED sales grew from USD 100 million in 2007 to 4 billion in 2013
Multiple Benefits of Energy Efficiency

**Monetising the economic and social outcomes of energy efficiency investments**

- Macroeconomic
- Public budgets
- Health
- Industrial productivity
- Energy providers
Two-thirds of the economic potential to improve energy efficiency remains untapped in the period to 2035 unless policy activity increases.
Building bridges . . .

International
- Energy prices
- Resource management
- GHG emissions abatement

National

More Public/Private Stakeholders
- Macroeconomic effects
- Job creation
- Energy security
- Public budget impacts

Sectoral
- Increased asset values
- Energy provider and infrastructure benefits
- Industrial productivity and competitiveness

Individual
- Health, wellbeing and social improvements
- Poverty alleviation: energy affordability & access
- Increased disposable income

The Public

More Public/Private Stakeholders

The multiple benefits of energy efficiency improvements

Energy efficiency is a means to enhance energy security, support economic and social development, and promote environmental goals.
Overarching macroeconomic impacts

**Investment effects**
- Increased investment in energy efficiency
- Higher production in energy efficiency sectors
- Lower production in other sectors

**Macroeconomic impacts**
- Employment
- Economic output
- Energy prices
- Trade balance

**Energy demand reduction effects**
- Energy cost savings
- Increased disposable income
- Higher business profits
- Improved energy security
Balancing public budgets

Investment effects

Energy savings effects

Cities

Municipal Utilities (water)

Public buildings
Improving health & well-being

Energy Efficiency Measures
- Weatherisation
- Heating & cooling systems
- Appliances

Indoor Exposure Factors
- Warmer, cleaner, drier indoor environments
- Reduced energy bills

Potential health improvements
- Physical health
- Mental health and well-being

Potential indirect social impacts
Boosting industrial productivity/competitiveness: from savings to value creation

- **Competitiveness**
  - e.g. ability to enter new markets, reduced production costs

- **Production**
  - e.g. capacity utilisation, improved product quality

- **Operations and maintenance**
  - i.e. improved operation, reduced need for maintenance

- **Working environment**
  - i.e. site environmental quality, worker health & safety

- **Environment**
  - e.g. air pollution, solid waste, wastewater, reduced input materials
Energy providers (Utilities): supporting a changing business model

Benefits for utilities: in resource constrained operating context
Benefits for consumers/indirect benefits for utilities: Increased affordability reduces customer default and associated costs
Rebound effect in the multiple benefits context

- Rebound can be a positive
- Not all benefits are dependant on energy savings – many occur independently
- Some benefits drive a rebound effect, others do not

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Energy security</th>
<th>Energy delivery</th>
<th>Energy prices</th>
<th>Macroeconomic development</th>
<th>Industrial productivity</th>
<th>Poverty alleviation</th>
<th>Health and well-being</th>
<th>Employment</th>
<th>Environmental sustainability</th>
<th>Public budgets</th>
<th>Disposable income</th>
<th>Asset values</th>
<th>Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entirely dependent on energy savings</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Could drive up energy consumption</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
Tailoring EE to national priorities

<table>
<thead>
<tr>
<th>Benefits vs. co-benefits</th>
<th>Country or stakeholder A</th>
<th>Country or stakeholder B</th>
<th>Country or stakeholder C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industrial competitiveness</strong></td>
<td>Co-benefit</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fuel imports</strong></td>
<td>Primary</td>
<td>Co-benefit</td>
<td></td>
</tr>
<tr>
<td><strong>Poverty alleviation and development</strong></td>
<td></td>
<td>Primary</td>
<td>Primary</td>
</tr>
<tr>
<td><strong>GHG emissions</strong></td>
<td>Primary</td>
<td>Co-benefit</td>
<td>Co-benefit</td>
</tr>
<tr>
<td><strong>Job creation</strong></td>
<td>Co-benefit</td>
<td>Co-benefit</td>
<td>Co-benefit</td>
</tr>
<tr>
<td><strong>Local pollution</strong></td>
<td>Primary</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Energy efficiency policies need to be tailored to the country context, and support the national or sub-national priorities for economic and social development.
## Important for developing countries

<table>
<thead>
<tr>
<th><strong>Energy access</strong></th>
<th>Helping countries to expand access, effectively enabling them to supply power to more people through the existing energy infrastructure.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic development</strong></td>
<td>Supporting economic growth through various aggregate benefits, for example by improving industrial productivity and reducing fuel import bills.</td>
</tr>
<tr>
<td><strong>Poverty alleviation</strong></td>
<td>Increasing the affordability of energy services for poorer families by reducing the per-unit cost of lighting, heating, refrigeration and other services.</td>
</tr>
<tr>
<td><strong>Combatting local pollution</strong></td>
<td>Reducing the need for energy generation – and lower associated emissions – through energy efficiency measures on both supply side and demand side.</td>
</tr>
<tr>
<td><strong>Climate change resilience</strong></td>
<td>Reducing the need for energy infrastructure, energy efficiency reduces the amount of energy assets exposed to extreme weather events.</td>
</tr>
</tbody>
</table>

**Multiple benefits are of particular importance for emerging economies and developing countries**
Proposed further research for stakeholders

- Expand analysis: depth and breadth
- Better understand the scope and scale of certain benefit areas
- Identify key relevant indicators and metrics and improve data
- Refine and develop impact assessment methods and address existing barriers to robust and systematic assessment
- Develop collaborative initiatives and data sharing opportunities to build coherency and consensus between approaches.
Some personal reflections

- Antidote for recession is to make better investments – like EE!
- Positive EE rebound in emerging economies can be much larger and more valuable than in developed economies
- EE policies often benefit vulnerable citizens best
- Crowding: design policies to crowd-in private investment
- Policy spillover: we all benefit from some country’s EE policies, Top Runner, Korean MEPS, flow on to all countries
- Some sectors require significant transformation: few countries can build low energy buildings at required scale
- Utility policies may be the best place to start
- A silver bullet? cost-reflective prices