Transforming the "Efficiency Gap" into a Viable Business Opportunity: Lessons Learned from the ESCO Experience in Sweden

Katie Lindgren
25 March 2009
Environmental and Energy Systems Studies, Lund University

Agenda

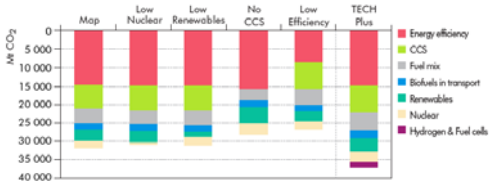
- Background: Why do we care about energy efficiency?
- Explaining the energy efficiency "gap"
- Sweden as a case study
- Role of ESCOs in promoting energy efficiency
- ESCO business characteristics and market opportunity
- Role of policy in spurring market development
- Lessons learned

Why do we care about energy efficiency?

- Climate change requires action
  - For target of 400-450 ppm CO_2-eq (~2 deg C) emissions must peak within a few years and then decrease rapidly (IPCC)
- Energy efficiency has tremendous potential to curb global energy demand and mitigate climate change
  - We could achieve approximately 8.2 GtCO2/yr savings by 2030 if a series of energy efficiency actions were implemented globally without delay (International Energy Agency 2008)
- By focusing on 'energy productivity,' we can decouple energy use (and emissions) from economic growth
  - Do more (or the same) with less (smaller appliances, more efficient engines, switching to more efficient fuel options)
- Energy efficiency is least expensive option & with positive economic impact!
  - A Green 'New Deal' featuring energy efficiency could create 200,000 new jobs in Sweden (Challenge Europe Project, British Council)

Among technical options for reducing emissions, energy efficiency has tremendous potential

CO_2-reduction below Baseline Scenario in 2050 within the Energy Technology Perspectives Scenarios of the IEA



Key point

Energy efficiency plays the most important role in CO_2 emission reductions, accounting for up to 53% of total CO_2 emission reductions.

But a puzzling "gap" exists between optimal level of energy efficiency and actual projects completed

Only 15% of profitable energy efficiency measures are carried out, according to recent investigations by Swedish authorities!
(SOU 2008:1 10)

Classification of barriers to energy efficiency (Based on SPRU, 2000)

Theory	*Barrier*	*Explanation*
Economic	Hidden Costs	Overhead costs, cost of collecting and analyzing information, production disruptions, inconvenience etc. are examples of hidden costs (Jaffe and Stavins ,1994)
	Access to Capital	This barrier may lead, e.g. to slim budgets which in turn affects the ability to invest in energy-efficient technology (Jaffe and Stavins, 1994)
	Risk	The reason why energy-efficiency measures are constrained by short pay-back criteria may be explained by risk aversion (Jaffe and Stavins, 1994)
	Heterogenity	Cost-efficient energy-efficiency measures may not always be able to implement because the technique is not adoptable in the company (Jaffe and Stavins, 1994)
	Imperfect Information	Large body of research documented that consumers are often poorly informed about market conditions, technology characteristics and impacts of own behavior (Howarth and Andersson, 1993)
	Principal-Agent relationships	The fact that the principal cannot observe what the agent is doing, may result in strict monitoring and control by the principal and thus result in neglecting of energy-efficiency measures (Jaffe and Stavins, 1994)
	Adverse selection	The purchasers may select goods on basis of visible aspects such as price if suppliers know more about energy performance of a good than purchasers (Jaffe and Stavins,1994)
	Split incentives	An implementation may become of lower interest if a person or department cannot gain benefits from an energy-efficiency investment (Jaffe and Stavins, 1994)
Behavioral	Bounded rationality	In theory decisions are based on perfect information, in reality it is often rather made by the rule of thumb (Simon, 1957)
	Inertia	Opponents to change within an organization may result in neglecting of energy efficiency measures (Stern and Aronsson, 1984)
	Credibility & trust	The information source should be credible and trustworthy in order to successfully deliver information regarding energy efficiency measures (Stern and Aronsson, 1984)
	Form of information	In order to increase the possibility of becoming accepted, information should be specific vivid, simple and personal (Stern and Aronsson, 1984)
	Values	If there are individuals with real ambition, preferably represented by a key individual within top management, efficiency improvements more likely to be adopted (Stern, 1992)
Organizational	Culture	A culture characterized by, for example a group of individuals holding environmental values may encourage energy efficiency investments (SPRU, 2000)
	Power	Lack of power within energy management may lead to lower priority of energy issues within organizations (SPRU, 2000)

Source: (Rohdlina, Thollander,Solding 2007)

Sweden presents an interesting case study in the market development for energy services

- "Small" country (approximately 9 million people)
- But, electric intensive industries and cold weather means Sweden has some of highest per capita energy use rates:
  - 17,000 kWh per person per year (Only Iceland, Norway & Canada consume more!)
- Yet Swedish carbon emissions are small in relation to other countries
  - Average Swede releases 5.8 tons of carbon dioxide per year compared with EU average of 8.6 tons and US average of 19.7 tons
  - 43 percent of the energy supply comes from renewable energy
  - 90% of electricity is produced from nuclear and hydro
- Extensive building retrofits are needed
  - Approximately 60 percent of the 165 million square metres in multiple-unit dwellings require renovations in the next 10 years (NEEAP 2008)

Polices have already promoted ESCOs; as an EU Member State, Sweden adopted energy saving targets

- National policies & instruments helped create incentives to shift energy use
  - Integrating climate policies in broader sustainable development policies
  - Regulations and standards
  - Tradable permits
  - Voluntary agreements
  - R&D
  - Taxes and charges
  - Financial incentives
  - Information and labeling campaigns
- A modest 1380 kEURO in public spending was used between 2001 to 2006 to kick-start Sweden's ESCO market
- EC Directive (2006/32/EC) on Energy End-use Efficiency & Energy Services: "*Member States must adopt and achieve an indicative target for saving energy of 9% by 2016.*"
  - Sweden quantified indicative target as 14% end use savings by 2016
  - 41.1 TWh in primary energy use - including weighting factors to convert energy end use to primary energy – or 32.3 TWh in energy end use

EC Directive pointed to the role of ESCOs for meeting national targets

- 'energy service company' (ESCO): a natural or legal person that delivers energy services and/or other energy efficiency improvement measures in a user's facility or premises, and accepts some degree of financial risk in so doing. The payment for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and on the meeting of the other agreed performance criteria.
- 'energy performance contracting' (EPC): a contractual arrangement between the beneficiary and the provider (normally an ESCO) of an energy efficiency improvement measure, where investments in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement.
- 'third-party financing' (TPF): a contractual arrangement involving a third party — in addition to the energy supplier and the beneficiary of the energy efficiency improvement measure — that provides the capital for that measure and charges the beneficiary a fee equivalent to a part of the energy savings achieved as a result of the energy efficiency improvement measure. That third party may or may not be an ESCO. (Directive 2006/32/EC).

Swedish ESCO market experienced a series of false starts amid broader energy history

1970s
- Oil crisis spurred interest in energy conservation.

1980s
- 1980 public referendum to phase-out by 2010 nuclear power
- HVAC equipment and HVAC entrepreneurs developed first energy performance contracts (EPC)
- Falling oil prices in the mid-1980s stymied further development.
- Customers viewed promises of EPC in a negative light, earning them the reputation of 'freezing in the dark,' creating a legacy of distrust among customers.

1990s
- 1991 carbon tax encouraged shift towards use of bioenergy for district heating.
- 1996 Market deregulation for the Swedish electricity market began. Energy companies looked to provide new "value-add" energy services.
- Several especially rainy years yielded excess hydropower, and energy prices in Sweden – especially electricity prices – fell, reaching a low in 2000.

2000s
- Rapid development in market for energy efficiency services

Perceptions matter: research evaluating how ESCOs interpreted the current market development

Survey Design
- Quantitative Data
  - Market sector focus, annual financial value of projects, & project size
- Qualitative Data
  - Services Offered and Business Characteristics for ESCOs
  - Industry Development Discussion Questions

Process
- Conducted 41 interviews between October 2008 and March 2009
  - 19 companies
  - Other relevant stakeholders including government authorities, agencies, customers, and non-customers (i.e.: examples of companies who have opted not to pursue ESCO assistance for energy efficiency projects)

Results demonstrate a strong and vibrant ESCO market developing in Sweden

- Tremendous growth in ESCO market
  - 27 companies (compared to 12-15 estimated in 2007 report)
  - 70million Euro (compared to 50-60 in 2007)
- ESCOs have built on customer base and expertise from 4 main areas:
  - Building and controls manufacturers
  - Facility management companies
  - Consulting firms
  - Energy supply companies
- Smaller companies also entering market and developing their own niche
- Public sector has led the way with ESCO projects
  - Some companies have 90% of their business there

Number of ESCOs	27
Type of ESCOs	Local and multinational
ESCO association	No
Annual Revenue (2008) for ESCO projects	Euro 68 million in 2008
Range of deal size	10,000 to 900,000 square meters

Rising energy prices, increased climate consciousness and policy are key market drivers

- **ESCO market is booming**: many companies report double digit growth and new companies continue to enter the market and develop their own niche
- **Mutual trust between companies and customers has grown**, leading to increased experience and comfort with energy services.
- **Third party financing has played a surprisingly unimportant role** in the ESCO business, in spite of the availability of offers to customers.
- **Culture matters** - Technical aspects of ESCO projects may not change in different countries, but cultural differences do affect energy performance contracts.
- **Rivalry among existing firms is marked by competition and cooperation**. Interoperability and open protocols have become an important industry trend within building and controls manufacturers

Despite rapid growth, ongoing challenges and opportunities remain

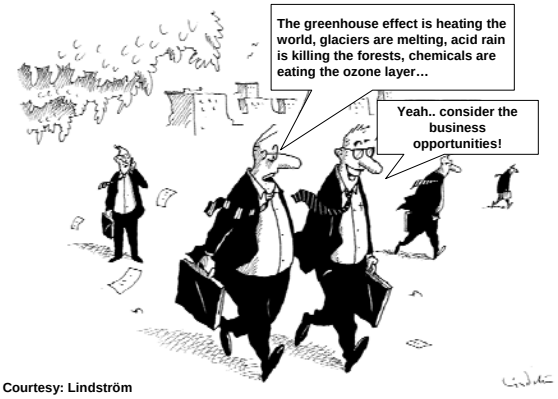
- **Limited human resources constrain further market expansion** and universities have been slow to respond to changing needs in labor market.
- **Lack of knowledge still remains a significant challenge** for developing savvy consumers of ESCO services who can negotiate contracts, use new equipment, and align occupant behaviour to maximize the energy savings potential.
- **Timescale of ESCO projects and "trust" issues may present a barrier to entry** for companies without an existing customer base or reputation behind them.
- **Falling energy prices is the biggest threat** of a substitute product or service.

Government still has a role in education, policy, and residential sector solutions

- Investments needed to strengthen energy efficiency related curriculum with universities, technical schools, and lower schools to build Sweden's human resource capacity in energy efficiency.
- Opportunity to connect existing programs like, energy declarations, with specific energy saving actions and measurable results.
- Additional efforts may be needed so national programs and policies keep pace as effects of global financial crisis continue to unfold.
- Creative thinking needed to develop new programs that address gaps in residential and small commercial sectors.

Final Thoughts: How & why small countries can make a big difference by promoting energy efficiency

- Leadership requires both words and actions - from countries large and small
- The 'invisible hand' alone doesn't guide us to optimal level of energy efficiency
- Political will matters and long-term planning is needed
- Energy efficiency offers job creation opportunities

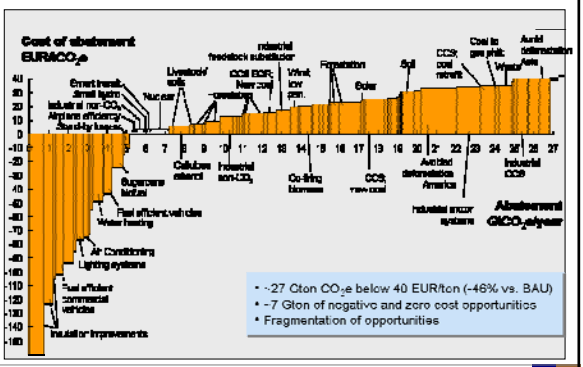


Courtesy: Lindström

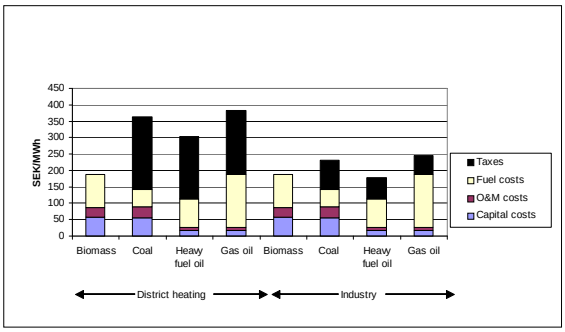
Kate.Lindgren@miljo.lth.se

Appendix

McKinsey/Vattenfall's abatement cost curve



Example: Heat production costs with 1999 taxes



Impact: Fuel mix in Swedish district heating