

Building Energy Efficiency

Popular Science Article based on the Doctoral Dissertation of Bernadett Kiss¹ at the International Institute for Industrial Environmental Economics

Over thirty years of experience shows that *energy efficiency* is the easiest, fastest, and cheapest strategy to reduce today's rampant energy use. To enhance energy efficiency, governmental intervention and business strategies are needed. The question of which governmental policies are the most effective to support energy efficiency remains unanswered. Policy learning and policy evaluations take us closer to the answer. This doctoral thesis provides valuable insights into which policies have supported energy efficiency in the building sector. The results show that mandatory energy performance standards of buildings, so-called building codes, and technology procurements are key policies for introducing energy efficient building technologies to the market. In addition, voluntary approaches, such as the passive house standard, testing activities and enhanced networking are essential business strategies for the diffusion of these technologies.

What is energy efficiency?

Energy efficiency is simply using less energy to provide the same level of service. The best way to understand this idea is through an example from our everyday life: When you replace a single-pane window in your house with a more energy efficient double- or triple-pane window, the new window is better at preventing heat from escaping in the winter, so you use less heat but maintain the same comfort level. If you still feel a bit chilly, you put on a sweater. Again, you use less energy by not turning up the heat and still maintain the same comfort level just by putting on more clothes. It is easy, fast and relatively cheap!

Buildings are responsible for more than one third of energy use worldwide. Because the lifetime of buildings is long, without energy efficiency measures a building commits to waste energy for 50-100 years. The good news is that energy efficient technologies already exist. For example, heating and cooling needs can be reduced by 50-90% in renovations. New buildings can be built with no energy demand, and it is even possible to build houses that produce rather than use energy. The bad news is that despite these innovations, energy efficiency improvements are still not a common practice.

How to enhance energy efficiency?

Policies to promote energy efficiency emerged in the 1970s. Such policies include energy demand limits for new and existing buildings, subsidies for new but expensive energy efficient technologies, or awareness raising campaigns to promote energy saving practices. However, not until the last decade did it become common to include policy evaluation (as a requirement) in the policy design. Consequently, we still lack the experience and knowledge derived from evaluations of the performance of different policy instruments. This research fills in some of the knowledge gap by assessing how different policy instruments have promoted the introduction and diffusion of energy efficient building technologies. Technologies include windows, insulation, heat pumps and passive houses. These technologies are of particular concern, because they are integrated into building systems, designed for relatively long lifetimes and consume large

¹ Online available from 21 May 2013: <http://lup.lub.lu.se/luur/download?func=downloadFile&recordOid=3738662&fileOid=3738663>

amounts of energy. The policy support of these technologies differs from country to country over time; in this study Sweden, Germany, the UK and Switzerland are assessed.

The results show that there is no single silver bullet. A combination of policy instruments is needed to successfully promote energy efficiency in buildings. These combinations call for timely and flexible government interventions. They have to be designed to support both the development of the technology and its emerging market. Building codes, technology procurement and voluntary standards were found to be key components of policy packages for promoting the diffusion of energy efficient building technologies. As a consequence of government intervention, the thermal performance of best windows available in Sweden has improved more than two-fold in the past forty years. In the same period, the market share grew from 20% to 80%. Another example of successful policy intervention is the emergence of markets for ground-source heat pumps in Sweden and Switzerland. Since the mid-1990s, the efficiency of ground-source heat pumps has improved by 13-36%, their yearly sales increased by 20-30% and their cost decreased 50% and 80% in Sweden and Switzerland, respectively.

The research also shows that different technologies require different policy support in the different innovation phases. Testing and funds for research and development, for example, were essential to develop a reliable and good-quality heat pump both in Sweden and Switzerland. In Switzerland, however, enhancing market diffusion depended on the intensive support of networks, while in Sweden the intensity of information campaigns and subsidies played a greater role. At the same time on the same market, in Sweden, subsidies did not play an important role in the diffusion of energy efficient windows, but networking was a key trigger.

The challenges of resource efficiency and climate change are huge and require both the public and private sectors to find approaches to sustain current living standards while minimizing environmental impacts. To tackle future challenges and find sustainable approaches, today's task is to evaluate and learn from past experiences. Consequently, governments need to know which policies are the most effective to best enhance energy efficiency actions. Today's policy evaluations are valuable input for policy-making processes and already improving the performance of future policies. This thesis contributes with more evaluation inputs and deeper insight into how to enhance energy efficiency in buildings and thus reduce today's extensive energy consumption.