

THE POTENTIAL IMPACT OF HEAT PUMPS ON ENERGY POLICY CONCERNS

SOME POLICY MESSAGES FROM THE IEA'S HEAT PUMPS PROGRAMME¹

1. Heat pumping technology could have a material impact on greenhouse gas emissions at a modest cost

Heat pumps should be considered very seriously as part of any portfolio of technologies aimed at reducing greenhouse gas emissions – and of policies to support the deployment of these technologies.

The most widespread use of heat pumping technology is currently in refrigeration and air-conditioning. Although there is scope to reduce greenhouse gas emissions associated with these applications, the greatest potential impact is by expanding use of the technology for space heating.

Previous analysis by the IEA Heat Pump Programme has shown that a 30% market penetration of heat pumps into existing heating markets would reduce total global emissions by about 6%. This can be set alongside figures from the IEA *World Energy Outlook* Alternative Scenario for 2030, which showed reductions from all sources of 16% and from end-use efficiency of nearly 10%. The potential impact of heat pumps is clearly material in this context.

The 6% figure could be increased:

- Efficiencies can be improved. Unlike boiler technology, current heat pumps are not operating near the theoretical limits of efficiency. Efficiency improvements are possible, albeit sometimes at increased cost
- Electricity generation can become less carbon-intensive. Most heat pumps are electrically powered. The lower the carbon emissions from for each kWh generated, the greater the benefits from heat pumps
- Market penetration could be higher. 30% is an indicative figure. At present though, there are only a few countries where heat pump use is as high as this.

The cost of saving a tonne of carbon dioxide emissions through heat pumping technology varies between countries (as does the cost of many alternatives). For heat pumps, the main causes of differences are climate; the nature of the electricity supply system – especially its fuel base; and the local cost of alternative heating systems and their fuels.

Very broadly, in most countries the economics as seen by consumers are only currently attractive in a few market segments. From the perspective of the costs imposed on society, heat pumps are comparable with the better renewable technologies: on a par with good examples of biomass or wind energy and lower than solar energy. However, there are countries where they are already attractive to consumers.

¹ The IEA Heat Pump Programme is one of some forty IEA **international collaborative energy technology R&D programmes**. Visit the IEA Heat Pump Centre at <http://www.heatpumpcentre.org/>

2. Heat Pumps can reduce exposure to supply risk

Supply risk is partly political and partly related to supply infrastructure reliability. Heat pumps cannot directly influence these risks but, like other energy-efficiency measures, their use reduces energy demand and therefore the scale of exposure to the risks. In so doing it makes risk management easier. The scope for reducing energy demand is essentially similar to that for carbon dioxide emission reduction discussed above.

Most heat pumps use electricity. Since electricity generation is not inherently fuel-specific, it offers more options for fuel diversification than other heating technologies.

3. Heat pumps can reduce infrastructure costs for energy supply networks

Developing economies have rising demands for energy to meet growing and essential needs of households and businesses. In consequence, large investments in energy supply infrastructure are needed. The provision of energy to households is particularly expensive. Because of the inherent economies of scale for energy infrastructure, using the same energy carrier for all services – including space heating – reduces total investment costs. The only practical universal energy carrier is electricity, and the most efficient way to use electricity for heating is with heat pumps.

4. Policy options

The policy instruments best suited to an energy problem clearly depend on the nature of the problem. Robust policies are unlikely to depend on a single technology, but to comprise a portfolio of measures and technologies. If there is sufficient confidence in market mechanisms, they may be “technology blind” (carbon taxes would be an example). Alternatively, they might be tailored to encourage different technologies differently according to their perceived costs and benefits.

For many technologies - especially those related to buildings, the rate of implementation can be constrained by the stock turnover period. For heating system this is typically of the order of 10 to 20 years, for complete buildings 50 to 100 years. Thus decisions by consumers or by policymakers have to be based on estimates (or alternative scenarios) of likely benefits over lengthy future periods during which it is unlikely that current conditions (especially energy prices) will pertain. In this situation of spending now in order to achieve benefits in the somewhat distant future, it is unlikely that market forces alone will be very effective in the short term.

For policies that distinguish between technologies, different instruments are appropriate to different situations. The table below summarises some typical instruments for different classes of cost-effectiveness (for example in terms of lifetime cost per tonne of carbon dioxide emissions abated). Specifically, a distinction is made between cost-effectiveness to the end-user and to society (including the cost of externalities).

and faster results. On this score, all IEA's 40 Implementing Agreement programmes have interesting success stories to tell.

Each country of course has a different set of constraints and priorities. But the exchange of experience and know-how is a powerful force for advancing the development and deployment of new, better performing energy technologies. It can notably catalyse much needed technological breakthroughs.

An important product of the collaborative process is policy analysis drawing on input of experience, which can help governments shape the most productive policies. The IEA Heat Pump Programme is pleased to feed its technical and market expertise into the IEA Secretariat's ongoing work on constructing robust analytical tools to help governments shape the policies that can best address today's tough energy challenges.