Imperial College London

UKERC
UK Energy Research Centre
Researching pathways to a low carbon future

What works?: A systematic review of heat policy options relevant to the UK context

Technology and Policy Assessment (TPA) Theme

UKERC

The Costs and Impacts of Intermittency:

An assessment of the evidence on the costs and impacts of intermittent generation on the British electricity network

Global Oil Depletion

An assessment of the evidence for a near-term peak in global oil production

Energy from biomass: the size of the global resource

An assessment of the evidence that biomass can make a major contribution to future global energy supply

November 2011

UKERC
UK Energy Research Centre

A report for UKERC by UKERC Technology & Policy Assessment Function

Low carbon jobs:

The evidence for net job creation from policy support for energy efficiency and renewable energy

Investment in electricity generation

the role of costs, incentives and risks

May 2007

The Rebound Effect:

an assessment of the evidence for economy-wide energy savings from improved energy efficiency

October 2007

UKERC
UK Energy Research Centre

A report for UKERC by UKERC Technology & Policy Assessment Function

Presenting the Future

An assessment of future costs estimation methodologies in the electricity generation sector

UKERC
UK Energy Research Centre

A report for UKERC by UKERC Technology & Policy Assessment Function

Energy Efficiency Evaluation:

The evidence for real energy savings from energy efficiency programmes in the household sector

What policies are effective at reducing carbon emissions from surface passenger transport?

A review of interventions to encourage behavioural and technological change

March 2009

UKERC
UK ENERGY RESEARCH CENTRE

Great Expectations:

The cost of offshore wind in UK waters – understanding the past and projecting the future

September 2010

UKERC
UK Energy Research Centre

UKERC
UK Energy Research Centre

A report for UKERC by UKERC Technology & Policy Assessment Function

Materials availability for low-carbon technologies: An assessment of the evidence

Overarching research question:

What policies and other factors have driven change/transformation in heat delivery technologies, fuels and infrastructure?

The project aims to capture:

- Full range of policy approaches used internationally to decarbonise heat supply and/or to change to new heating infrastructure / technologies
- Range of metrics that the success of these policies can be measured against
- Contextual information that may have influenced the success of particular policy approaches in particular geographical regions or at previous points in history

Also:

- Consumer angle
- Business/ public sector angle
- Policy packages.

Rapid evidence assessment – research sub-questions

- What are the factors which determine the success of the policy (including addressing barriers, other regulatory issues, market structure and historical factors)?
- What is the impact of external factors (for example, high fossil fuel prices, heat density, or availability of natural resources)?
- How are the outcomes affected by the aims of the policy?
- Would this policy (or aspects of the policy) work within the contemporary UK energy market context? What are the lessons for UK policy?
- Is there evidence of which is the most suitable delivery/engagement agent, or of the advantages of a particular configuration of national and local action?

Heat pumps: findings (1)

- **What specific features make policies effective?**

e.g. How do design and types of subsidy influence effectiveness?

Sweden: investment subsidies for HPs limited to discrete and short-lived periods of time, leading to booms and busts of installation activity and higher risks of technical standards of installation being compromised during periods when subsidies have been available.

- **In which cases are specific policies needed?**

e.g. Sweden, Germany and Denmark in the early to mid-1980s - success of public subsidy support depends upon sufficient manufacturing and installation standards.

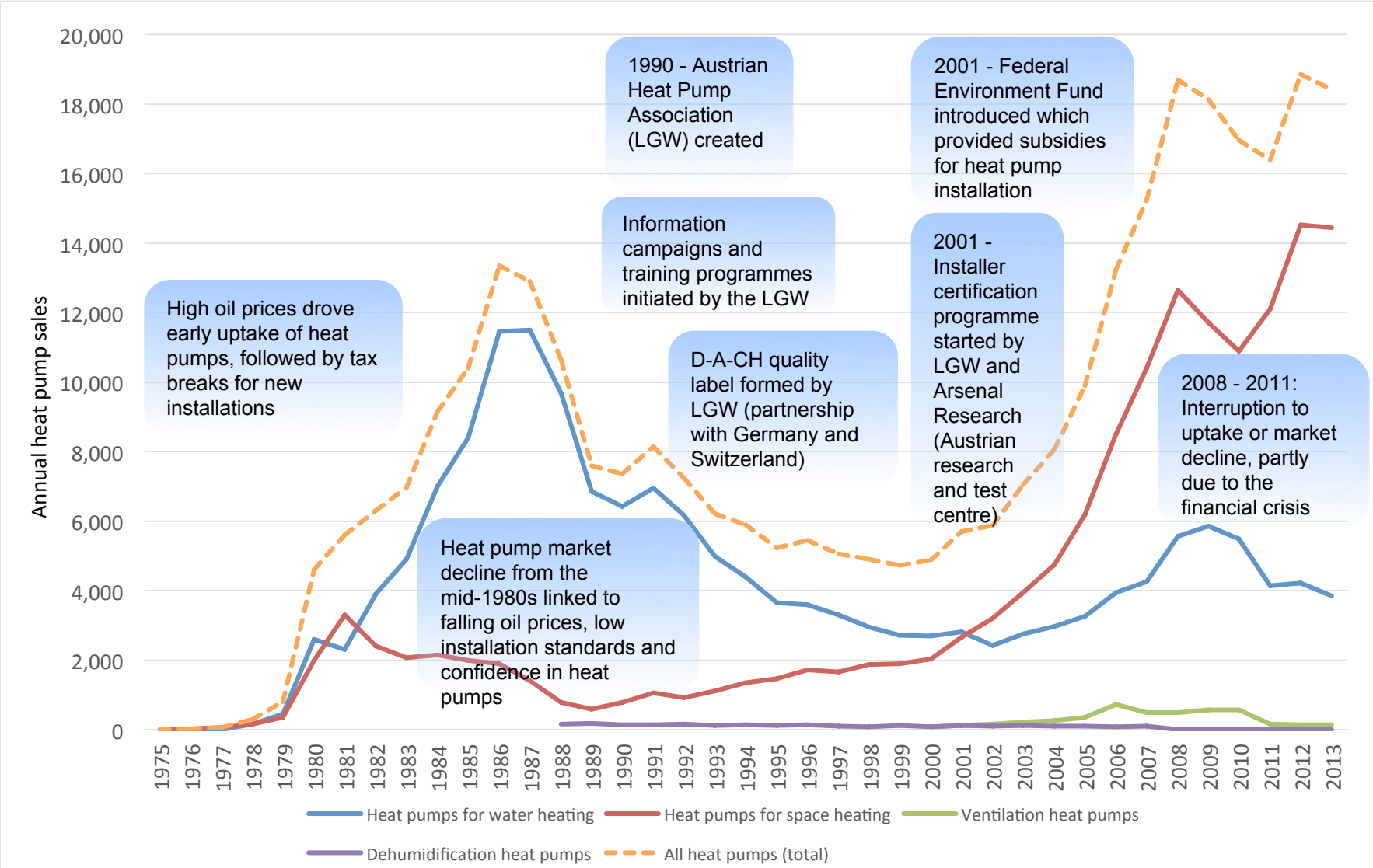
- Timing of policy interventions should consider stage of technological innovation

- **How does the sequence or combination of policies influence effectiveness?**

e.g. Germany, Sweden and Switzerland - recovery and growth in heat pump sales from the early 1990s, through a combination of promotion, information campaigns, subsidies and technical standards.

Austria policies and market development 1975-2013:

Oil prices, tax breaks and subsidies, information campaigns, standards and quality assurance, financial crisis



The case of Sweden: fossil fuel taxes and technology neutrality

Jan-Erik Nowacki (Swedish Refrigeration & Heat Pump Association) attributes widespread uptake of HPs, particularly in small dwellings, more to substantial fossil fuel taxes, tax deductions for the costs of labour required for heat pump installation, and favourable economics (e.g. cheap price of electricity, higher costs for DH due to privatisation) rather than investment subsidies.

Bjorn Telenius, Swedish Ministry of Environment and Energy:

"… the main strategy for this and most previous governments has been to use technology neutral policy instruments such as CO_2 tax, etc. As a result the fossil fuels are simply too expensive to use for heating in comparison with biomass, heat pumps, etc. Choosing technology neutral incentives create competition between renewable energy technologies, thereby promoting the use of the most cost-efficient solutions – which in Swedish heat production normally means district heating based on biomass, and heat pumps in stand-alone installations … There is no direct subsidy for heat pumps, other than indirect ones such as e.g. CO_2 tax"

Heat pumps: findings (2)

- **How does context influence policy effectiveness?**

e.g. Relatively cheap gas heating provided by UK's extensive natural gas infrastructure impacts adversely on heat pump adoption. Germany – successful heat pump uptake despite 42% of households supplied with natural gas heating.

- **Determining the role of policy support, continuity and stability**

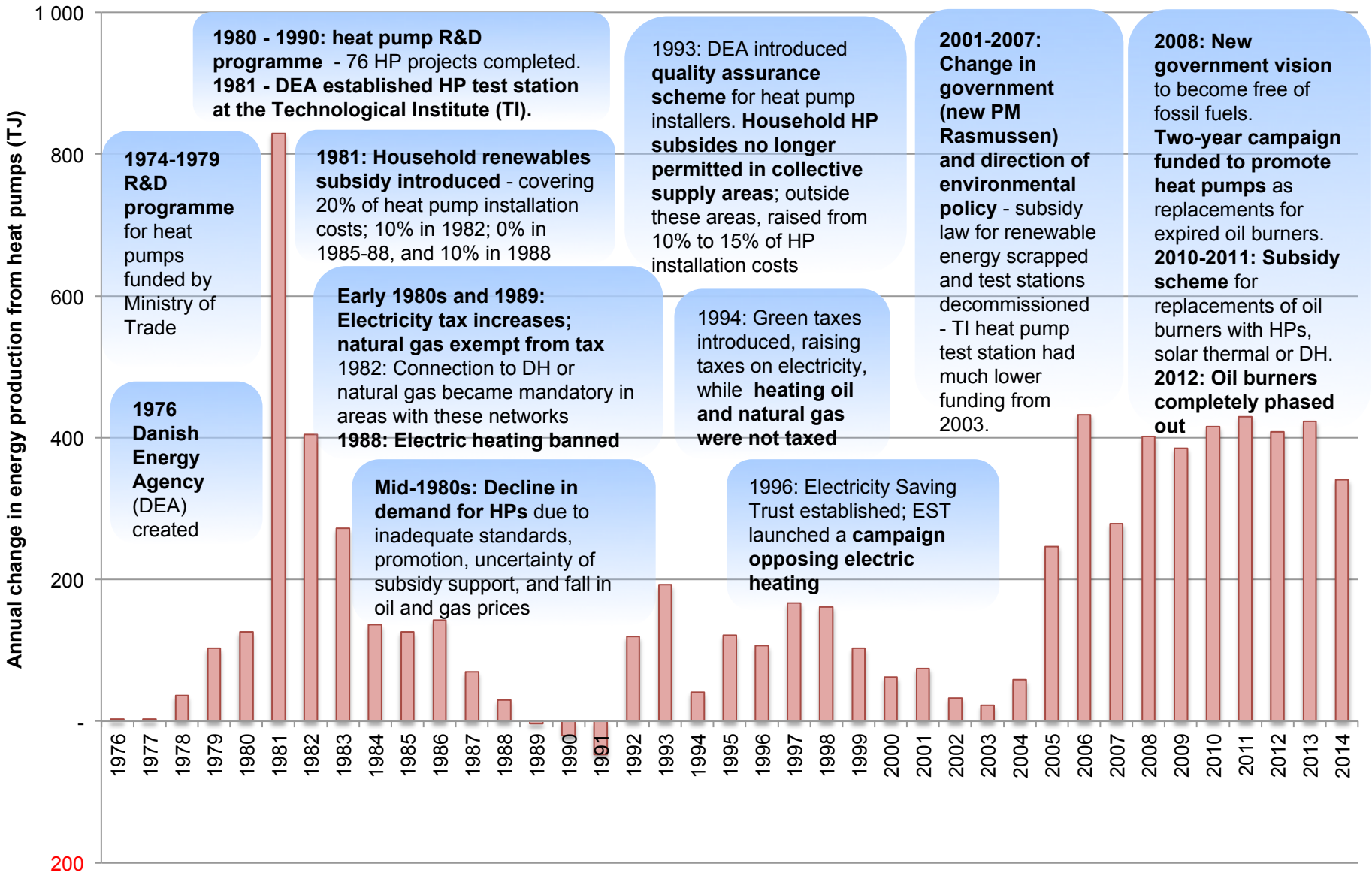
e.g. Heat pump deployment in Denmark affected by varying political support for the environmental agenda, opposition to electric heating, or lack of recognition of heat pumps as a legitimate form of renewable energy.

- **Determining the appropriate balance between policies which incentivise heat pumps and those which support the development of collective heat supply (e.g. district heating, natural gas)**

e.g. Denmark – mandatory connection to DH or natural gas networks; ban of heat pumps in collective supply areas; increased subsidisation of heat pumps outside collective supply areas.

Denmark policies and market development 1976-2014:

R&D, HP test station, household subsidies, electricity taxes, low policy prioritisation, shifting policy support, disincentivisation of / phasing out of heating oil



District heating – findings (1)

- **In which cases are specific policies needed?**

e.g. Up-front funding was not involved in the extensive development of district heating seen in Denmark and Sweden. However, most development took place before energy market liberalisation, with district heating companies owned and/or controlled by municipalities, and risk reduced through planning and regulation of heat supply.

- **What specific features make policies effective?**

e.g. Financial support may enable the development of district heating since it is capital intensive. Grants reduce risk to a greater extent than loans, but may reduce developer accountability and lead to less well designed systems.

- **Political acceptability of policy instruments**

e.g. Oil was taxed from the start of district heating development in Denmark in the 70s, and this tax was raised after oil prices fell in the 80s, allowing CHP systems to be run profitably. Denmark now has one of the highest energy taxes in Europe.

District heating – findings (2)

- **Engaging sufficient customers**

e.g. District heating schemes may need to access high proportion of the heat market in the area they supply to operate economically. In the UK, securing and growing a customer base is perceived as uncertain, discouraging investment.

- **Heat planning/zoning to support the development of networks**

e.g. European countries with high levels of district heating have greatly reduced risk of demand uncertainty through heat planning, including granting monopoly powers to district heating companies, leading to ability to access capital at very low rates, and willingness to invest for relatively low rates of return.

- **Determining the role of policy support, continuity and stability**

e.g. Policy stability is a key success factor: in Iceland and Denmark, perceived policy stability means banks compete to loan to district heating projects.

- UK: short-term abruptly changing policies relating to DH development have created uncertainty and perceived risks for local government and commercial sector.

Heat pumps and heat networks: common themes and interim conclusions

- **Policy stability, continuity and support is a key success factor for both technologies.**

- **High up front costs can be a barrier to uptake of both technologies.** District heating involves capital costs both at household level and also with the development of the heat network; in addition, the capital investment may be seen as more risky because heat demand in a specific area must be maintained over time to ensure viable returns.

- **Subsidies for replacement of oil boilers/ electric heating may be effective in stimulating the uptake of both heat pumps and district heating**. Fossil fuel taxation also has been effective in deploying these heat technologies but would politically unrealistic in the UK.

- In the UK, high consumer satisfaction with gas central heating systems means many consumers say they would be unwilling to consider alternatives. **Across Europe, both technologies have been most widely deployed where natural gas networks are less extensive.**

- **Low consumer awareness and confidence forms a barrier to the uptake of both technologies**; enhancing the reputation of the industry through standards and regulations has been important in overcoming this barrier. For district heating, price regulation may also play a role in reassuring consumers.