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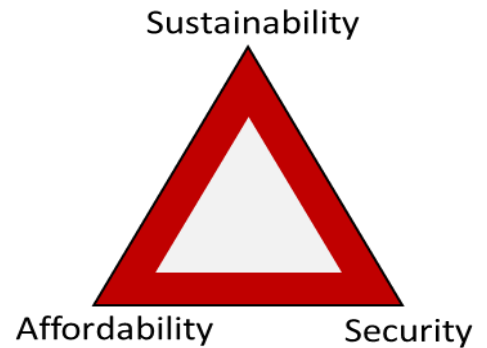
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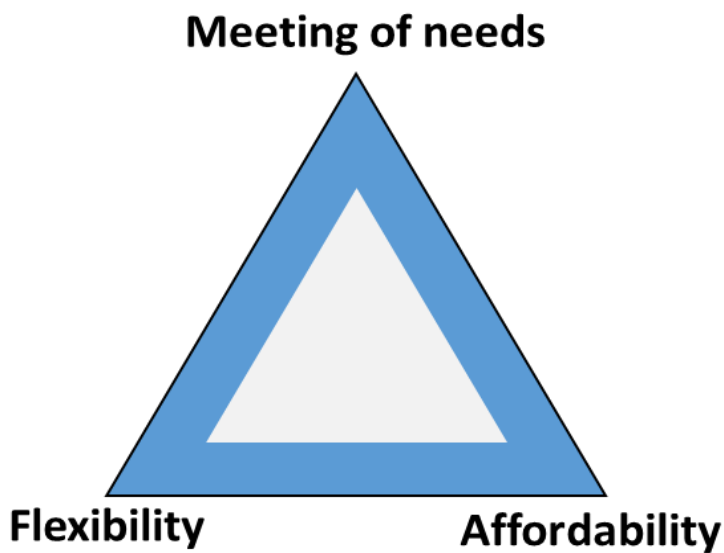
The Energy System challenge... Supply & Demand working together

The well known Energy Trilemma provides a useful framework for considering the three main broad objectives of energy policy, and the trade-offs involved in trying to address them all. It is however inherently **supply focused** with attention focused on what the energy industry can do. *What is missing is a focus on the individual needs and choices that form the demand side of the energy problem.*



It is vital that the power of the demand side is harnessed when considering the design of energy policies. We propose a linked trilemma which challenges the wisdom and open debate about the trade-offs and tensions involved in designing effective energy policy, and how they support solutions to holistic energy issues.

A Demand-Side Energy Trilemma



Our **demand side trilemma** illustrates the main drivers of the consumers' decisions regarding energy consumption. Consumers want to meet their energy service **needs**, but wish to do so **affordably** and **flexibly**. The traditional supply and this demand trilemma share a focus on affordability, linking them into a combined framework.

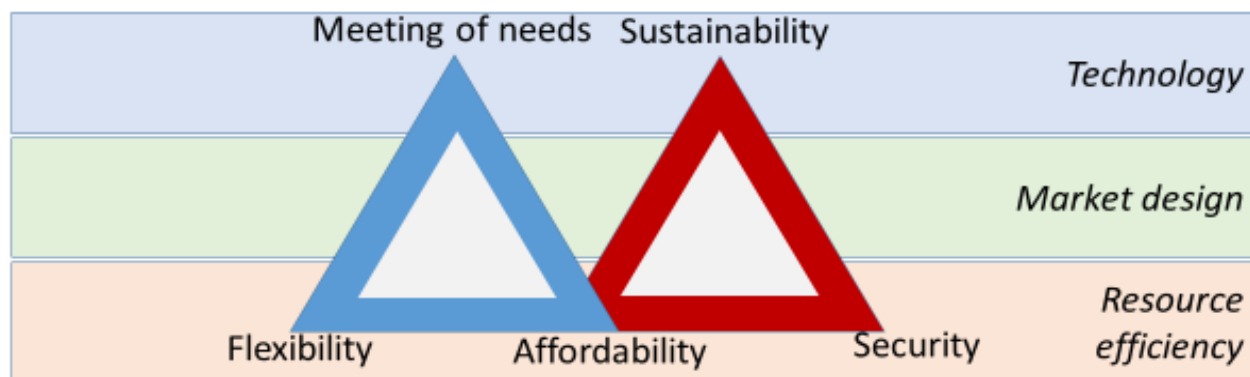
This briefing reflects on the links between the two trilemmas, along with what type of enablers could be used to reconcile the tensions between the different peaks of both trilemmas.

A Dilemma of Trilemmas?

As with the supply trilemma, trying to meet all three aspects of the demand-side trilemma inevitably leads to an assessment of different trade-offs.

- Meeting energy service needs costs and can, for many, be in tension with affordability.
- A lack of flexibility means that a consumer cannot align their energy demand with the availability of lower cost sources.
- Meanwhile, being flexible today (and thus potentially alleviating affordability) would usually mean changing what you want; adjusting your consumption away from meeting needs.

Trilemma for the 21st Century: the full picture



Solving the Trilemmas

We must work to put demand and supply on an equal footing within energy policy. Addressing demand side policies, puts the customer at the heart of the issue – truly moving towards democratising energy whilst emphasising the need to reduce intensity.

This **new energy demand trilemma** of **flexibility**, **meeting of needs** and **affordability** will greatly help to refocus the debate.

Without changes to the make-up and organisation of our energy system we will struggle to create an environment where consumers can match their needs, flexibilities and budgets to the availability of cheap, clean and secure energy. Linking of the two trilemmas requires **enablers**; the right **technologies** connecting consumers and suppliers through **markets** designed to encourage demand side participation and aggregation are needed to harness the inherent flexibility of the demand side, whilst major increases in **efficiency** can ensure that needs are met at affordable prices.

Demand-side policies will always face challenges. They are required to get different individuals/households, with different preferences and/or objectives, to adopt more socially beneficial energy consumption behaviors. That is exactly the point where the energy industry, via enablers, can aid to bridge the differences between the consumers and facilitate relevant policies.

Although technology innovation has readily transformed many aspects of life, it has had limited impact on the energy industry.

Powerful ways in which technology could contribute to successful energy policies, include:



1. Advances in **data analytics** and **home automation**, that allow for a more efficient use of existing resources

2. Innovations in **computer processing** power making artificial intelligence and machine learning ever more applicable, which could lead to the optimisation of scheduling and despatching generation



3. Constant reduction in costs of **communications**, **data storage** and **sensors**, enables remote monitoring and condition based intervention

Market design

You get what you design for.

A fundamental rethink of all the industry codes and regulations, in all three parts of the industry; generation, networks and retail is required to refocus from supply-side to demand-side solutions. Fundamental steps, and innovation companies already working in this space, include:

1. A high level of **aggregation** - the larger the number of consumers that adopt the proposed changes, the more effective they become. For instance **Flextricity** have created a draft agreement "Footroom" with National Grid, to increase the role of Demand Turn-up to address periods with very low electricity demand
2. Enhancing the role of **distributed** energy supply and demand. **VCHARGE** Turn It On for example have developed an approach that uses intelligent response to increase the role of virtual power plants.
3. Facilitating **non-traditional business models**. **Open Utility** for instance have launched "Piclo" an online peer to peer energy marketplace.

Resource efficiency

To help deliver a sustainable future.

Reducing the quantity of energy we use is vital to support the decarbonisation of the energy system. Interventions on each component of the system involve:

1. **Efficiency in providing services**, i.e. efficient use of energy to meet our energy-requiring activities such as heating, lighting, cooking etc. **Sunamp** Heat Batteries is an example of energy efficient heat storage technology.
2. Designing a system that allows us to **link generation and demand more efficiently** to facilitate a better use of resources.
3. **Resource efficiency at the production level**. Use of an appropriate mixture of technologies to generate energy by using the least amount of resources provides economy-wide benefits. **CEP** research has shown that improved energy efficiency could lead to a wider set of socio-economic benefits.

Collaborating parties

Dunelm Energy Ltd

Ian Marchant, CEO and Visiting Professor at CEP

e: ruth@dunelmenergy.co.uk

w: www.dunelmenergy.co.uk

Jenny Carson, Research Assistant

e: jenny@dunelmenergy.co.uk



DUNELM ENERGY

University of Strathclyde Centre for Energy Policy (CEP) and EPSRC EUED

Karen Turner, Professor and Director of CEP

e: karen.turner@strath.ac.uk

Antonios Katris, Research Assistant

e: antonios.katris@strath.ac.uk

Web-sites for CEP, our EUED project, EPRC EUED initiative

w: www.strath.ac.uk/ippi/aboutus/centreforeenergypolicy

w: www.cied.ac.uk/research/impacts/energysavinginnovations

w: www.eueduk.com



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EPSRC

Engineering and Physical Sciences
Research Council

University of Strathclyde Institute for Energy & Environment

Simon Gill, Researcher

e: simon.gill@strath.ac.uk

Stuart Galloway, Reader

e: stuart.galloway@strath.ac.uk

w: www.strath.ac.uk/eee



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