

Beyond Power

Integrating Energy Hubs into Multicommodity Energy Systems

September 2024 Michiel Dorresteijn



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Introduction to Baringa Energy Advisory

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Our Rotterdam team of Market & Power experienced consultants transaction **Purchase** Digitalisation Hydrogen with deep insight in the reports Agreements £Ø Dutch energy market Offshore Scenario infrastructure at≣ helps you navigate the studies 4 challenges of the energy transition, building on our international expertise Energy Innovation storage and successful solutions support development from the markets we Ļ Connections work in across Europe, & Flexibility and beyond.



The energy transition is well underway

Renewable power generation has become an important factor



Infeed congestion in The Netherlands



Source: www.NetbeheerNederland.nl

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The energy transition is well underway

Electrification of energy demand has become mainstream

Electrification of transport (EV)

Residential and industrial heating (heat pumps)

Large battery systems

New developments: electrolysis, data centres, etc.

Demand congestion in The Netherlands







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Energy Hubs can unlock flexibility needed in the power system

Energy hubs: facilitating local exchange and optimisation of energy



Several studies show: distributed flexibility is needed and energy hubs are an effective means to unlock that

Local flex solutions can help:

- Reduce need for transport capacity (local generation is consumed locally)
- Aggregating flex (easier to access/contract for system operators)

Organising local energy flexibility is nothing new: CDS for industries, micro-grids, smart grids, local aggregators and nowadays energy hubs

But local energy cooperation is still not widespread and a bit of a niche



Why are there so few successful energy hubs?

- No clear financial incentives for participants (limited and changing flex-remuneration)
- Complex and difficult to lift off by local organisations
- Limited trust in incumbent suppliers that could help
- Codes and regulation very much focused on the high-level system needs, ergo the perspective of incumbent parties
- Initiatives like USEF, LES, Energy Exchange and many other good groundwork, are still considered 'demonstration cases'

How do we get the desired value for <u>all</u> stakeholders?

We think three elements are essential for sustainable energy hubs



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Key drivers for value stacking in energy hubs: interconnection and hybridization

An interconnected, multi-commodity energy hub brings more value to both customer and system

Trade possibilities on multiple markets

- Open to exchange energy with regional, national or even global marketplaces
- Incentives (Local before regional? Green before grey? Etc.)

Optimize and arbitrate between commodities

- Hybrid assets, e.g. combination of E-boiler and gas-boiler for steam production
- P2X, X2P systems (heat storage systems, fuel cells)





Cost of electricity

Governance has to be fitting from top to bottom It is like a jigsaw

- Strategic planning, regulation, delivery and policy will all help or hinder progress on energy hubs to fulfil their potential
- Governance of energy hubs relates to a range of complementary areas
- Fitting all pieces together requires a system approach considering system value as well as participant value



Governance and operating models for energy hubs facilitated by Baringa

Focus on system value as well as the prosumer perspective

Energy Exchange (UKPN)	Power Potential (UKPN)	FUSION (SPEN)	ExtenDER (SSEN)
Evaluated different market-based solutions to enable organisations with flexible generation connections that has a risk of curtailment to trade their likelihood for curtailment. The objective was to support the delivery of a low carbon future.	The development and creation of a regional reactive power market for DERs connected to the distribution network to provide dynamic active and reactive power services for transmission constraints to the ESO in GB.	Commoditised flexibility marketplace with domestic DERs following USEF approach. Project initiation, market sizing and support finalisation of project.	Design, simulation and potential trial of how flexibility propositions will be enabled (or hindered) under potential REMA (Review of Energy Market Arrangements) scenarios.
	Flexible Plug & Play (UKPN)	Dynamic Networks (SSEN)	
	Develop and trial new technologies and commercial arrangements in order to connect distributed generation to constrained areas of the electricity distribution network.	Investigation and potential trial of a real-time platform for the management of residential DSR to enable faster connections for planned housing developments.	



A proven operating model: Local Energy Oxfordshire (LEO)

An example project that provides the functions for a Smart Community Energy Scheme (SCES)



Building blocks for SCES

- Physical Elements: These encompass the community DERs, the households and the local businesses
- Facilitating entities: These are the local authorities, the suppliers and the SCES enabler/ local convener
- Customer Products: These are what is offered to members of SCES e.g. generation installs, PPA's/ local tariffs etc.
- SCES enabling services: These are services that require the physical elements e.g. selling/ buying energy, flexibility services etc.
- Functions: This is the aggregator platform which enables the RtM for the physical elements e.g. the metering, comms, billing, optimisation etc
- Social elements: All the social aspects of the above e.g. recruitment, behaviour, learnings and Energy Champions



Value proposition: Illustration of how increased SCES complexity can unlock increased value proposition – both for the customers and for the DSO





While energy hubs need value stacking, value stacking at energy hubs requires an adequate governance and operating model



Opening up the scope of an **energy hub beyond power**:

- can generate more energy cost savings for individual customers by adding optimization opportunities
- can reduce overall system costs by creating more flexibility options which can become available for the system at a lower price
- can reduce carbon emissions as it can reduce peak demand by adding storage and buffering options and optimize energy use on carbon emissions

But a fit-for-purpose governance and operating model is essential to unlock the potential of energy hubs

Value stacking for a solid business case

Governance model to give value to all stakeholders

Operating model to make it work



About the Author

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Michiel has a track record of more than 15 years in the energy sector, both in policy making as well as in energy consultancy. At Baringa he combines consultancy assignments with business development in Baringa's Energy & Resources – Retail, Networks and Water department. Based in The Netherlands, he specializes in shaping new energy concepts into feasible solutions for the transition related challenges that both policy makers and market participants may face. Michiel has driven several projects where a focus on the interaction between grids, system operation, and demand and supply led to actionable market process designs.



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