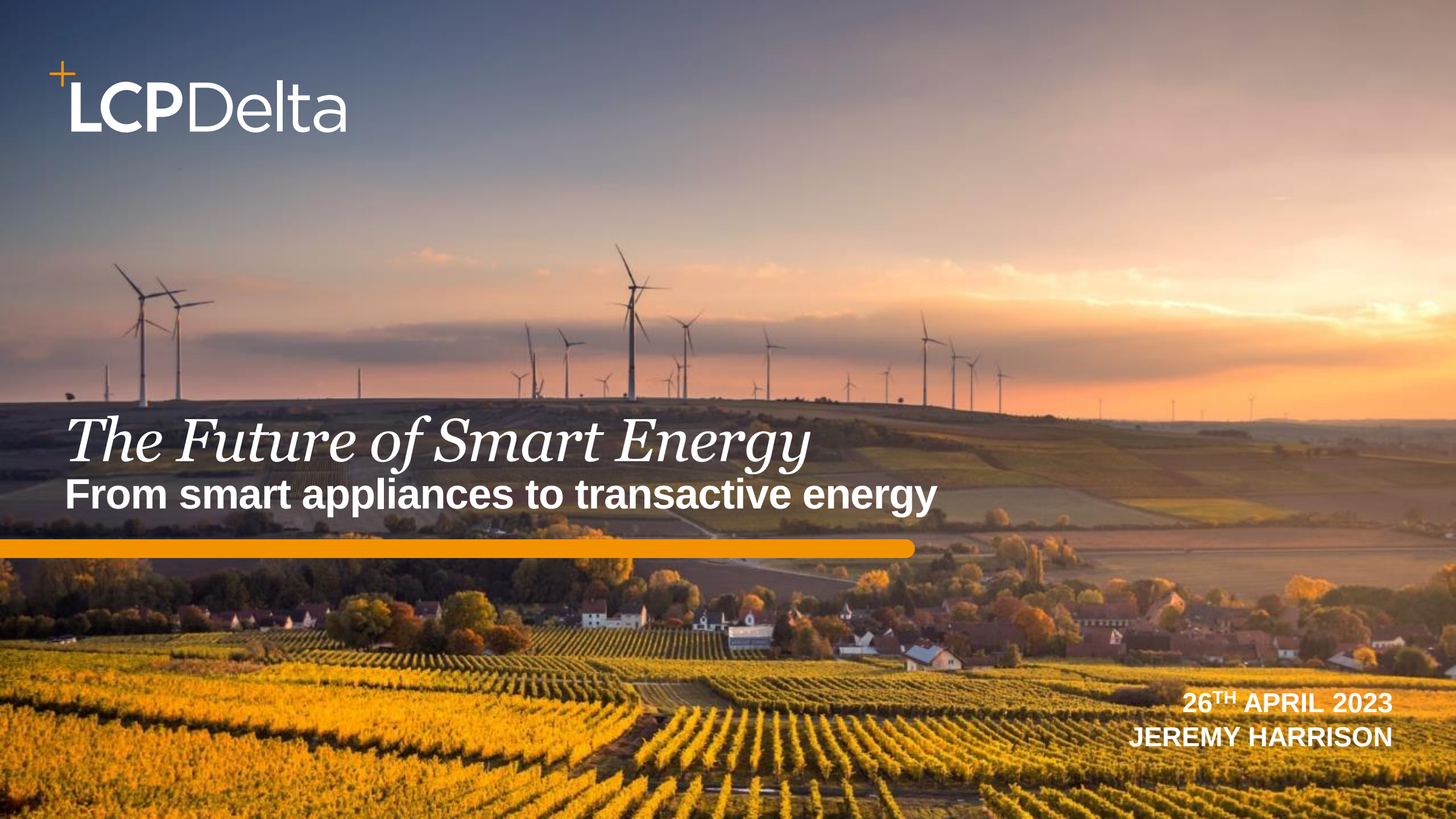

LCPDelta

The Future of Smart Energy

From smart appliances to transactive energy

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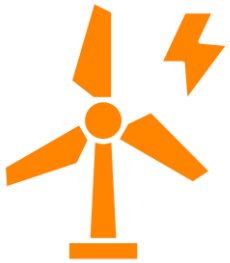
The future of smart energy
What is the problem we are trying to solve?

As Europe decarbonises using renewable electricity, we face challenges to maintaining a secure and affordable energy system



The transition to renewable generation

In the transition to new energy, despite its demonstrable benefits, we face significant challenges to the conventional grid topology, namely:

- Intermittent renewable generation
- Less dispatchable thermal plant and system inertia
- Generation embedded within low voltage networks

The growing demand for electricity

Just as the supply side is facing challenges, so the demand side is becoming increasingly dependent on electrification both to serve new demands and to replace conventional energy sources including in:

- Mobility
- Heat
- Home working

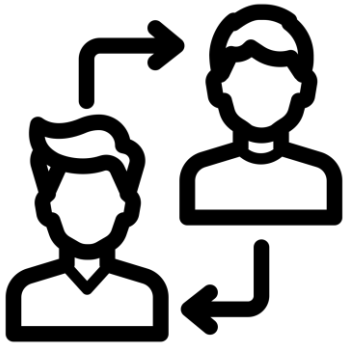
Whilst it may be possible to accommodate these changes using conventional investment in physical assets, it can be both costly and slow to implement.

In many instances Transactive Energy may represent a cheaper, more effective and quicker solution.

Transactive Energy
What is it and how smart is it?

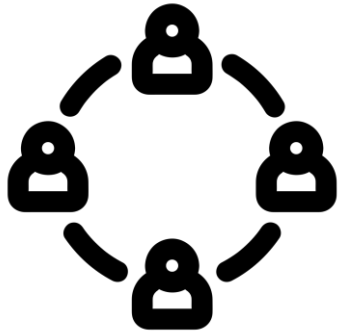
A system of economic and control mechanisms that allows the dynamic balance of supply and demand across the entire electrical infrastructure using value as a key operational parameter*

Transactive energy includes a variety of business models ranging from the well-established demand response and flexibility markets to more innovative and complex concepts such as Peer-to-Peer (P2P) and Collective Self-Consumption (CSC)



In P2P schemes, individual prosumers can generate their own energy from, for example, rooftop solar panels or micro-CHP and trade it with other community members

In neither P2P nor CSC is there necessarily any reflection of value to the wider energy system, although this can be included in some business models

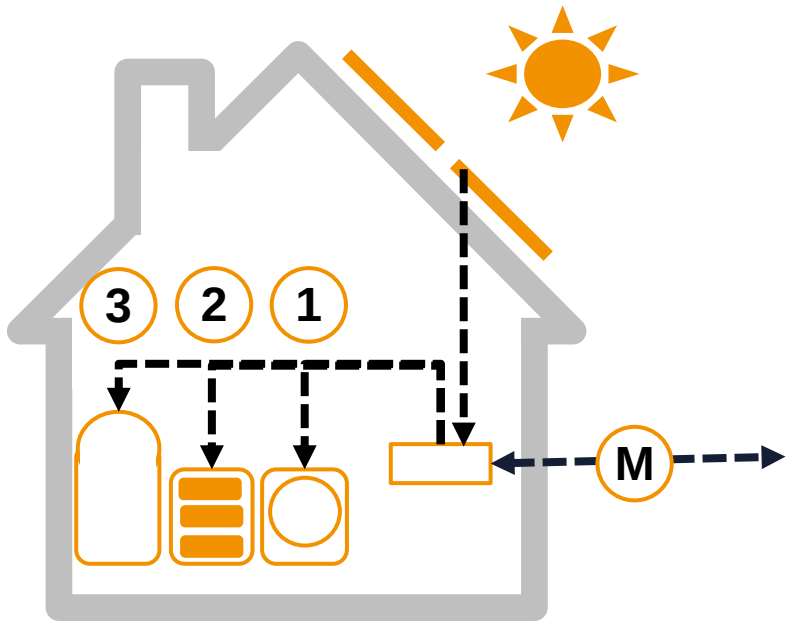


In CSC schemes the output from communally owned assets is shared amongst community members according to pre-determined rules

**Definition of Transactive Energy from the GridWise Architecture Council*

Optimising self-consumption
Maximising value for the individual home

In order to optimise value from self-generated solar electricity, and so pay back the investment, systems are usually configured to maximise self-consumption



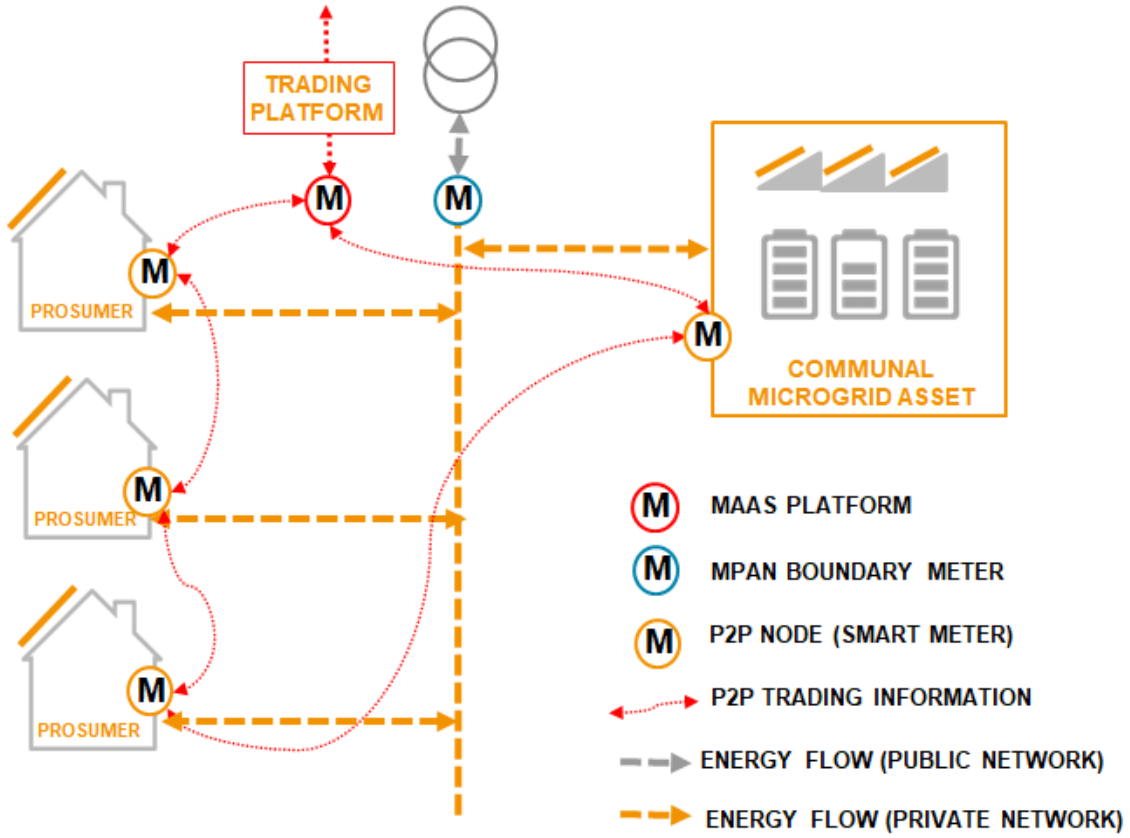
- The key to capturing value is to ensure that as much as possible of the generated electricity is consumed within the home to avoid importing expensive grid electricity.
- To this end it is common to direct the energy to on-site loads as a priority (1), followed by excess sent to energy storage (batteries) (2)
- Depending on opportunity value of power, any remaining power is either consumed in non-priority, low value loads (such as hot water production) or exported for trade (3)
- Smart appliances (1) help to maximise value to the householder but provide little if any value to the wider system
- In some cases the householder may commit to some form of demand response in which they will adapt their energy usage to align more with the needs of the energy system

Optimising the local energy system
How individuals work together to support the community

How the individual energy assets can work together to optimise generation and consumption within an energy community

How a community microgrid works

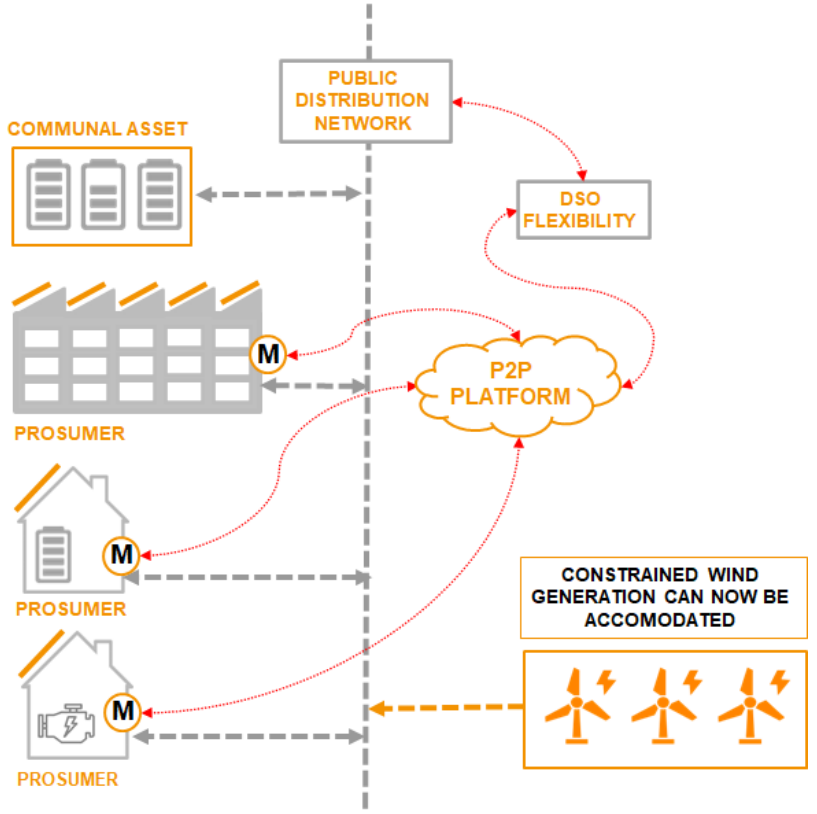
- Diagram shows a community microgrid transacting energy over a private wire network
- This configuration optimises value by avoiding unnecessary network charges
- However, other configurations are possible and are more common when energy communities are established using existing networks
- In the case of P2P communities, individual prosumers transact energy with one another via the trading platform which may also reflect system values (such as ESO/DSO flexibility)
- For CSC communities, the output from common generation assets is shared according to pre-determined rules



Transactive Energy in practice
Local Energy Market, Cornwall (UK)

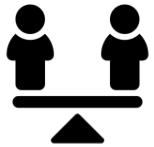
The local DSO (WPD), working with energy supplier Centrica, has established a trading platform to incentivise prosumers to support the distribution network

- Cornwall is a highly constrained network which faces challenges both in connecting new renewable generation and new loads
- Conventional approaches to providing the required additional capacity are costly and take many years to implement
- Innovative “non-wires” approaches may be cheaper and quicker to implement
- WPD uses the market platform to obtain flexibility services which mitigate system constraints
- Prosumers include buildings with micro CHP, solar PV and batteries
- Although the prosumers are trading energy with one another, they are also meeting the DSO flexibility needs which helps overcome network congestion



How transactive energy is facilitating the energy transition

- Enhances system resilience by incentivising investments in resilient system configurations such as microgrids



- Increases system efficiency by matching local supply and demand

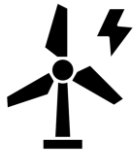
- Reduces network investments by managing peak loads

- Mitigates the impact of electrification of heat and mobility by incentivising generation to match demand profiles

- Supports new lifestyle patterns such as homeworking

- Generates mutual value from energy communities rather than simply accommodating them

- Overcomes constraints on the connection of new housebuilding



- Facilitates the connection of renewable generation

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