An Energy in Buildings Strategy

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SEA Manifesto

The Economic Case
- Energy Solutions in Buildings are Cheaper
- Buildings as an Infrastructure Priority
- Info-graphic Analysis

Economic Case Proposals

An Energy in Buildings Strategy
- Existing Policy Landscape
- Cross-Department Approaches
- Whole Building Approaches

Strategic Policy Proposals

Deep Retrofit of Buildings
- A National Infrastructure Priority
- Linking taxation & energy consumption
- Devolved Delivery (regional rollout)
- Lessons learned from Warm Front

The Future of Heating
- Moving from subsidy to regulation
- Energising installers
- New Build Heating (Building Regs)
- Focusing on Off-Gas & Fuel Poverty

Buildings Policy Proposals

Buildings in the Energy System
- Buildings as a DSR solution
- Consumer benefits of micro-generation, storage, ToU tariffs, and smart meters
- A smarter environment from existing controls

Energy System Proposals

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High Level Proposals for Government

- ✓ Make building level energy solutions a policy priority and understand their economic benefits
- ✓ Introduce an Energy in Buildings strategy
- ✓ Develop long term policy which moves the market from subsidy to planned regulation
- ✓ Secure the RHI budget to 2020
- ✓ Treat the retrofitting of the UK’s buildings as a national infrastructure priority.
- ✓ Energise the installer base to engage with consumers and deliver increased deployment
- ✓ Prioritise mechanisms to reduce fuel poverty and support off gas grid communities
- ✓ Consider community-led or regionally orientated approaches to rolling out technologies.
- ✓ Empower consumer by introducing ToU tariffs with smart metering for building level technologies
- ✓ See Building-level technologies as a solution for Demand Side Response
- ✓ Optimise the use of existing technologies innovatively to deliver a “smarter” grid

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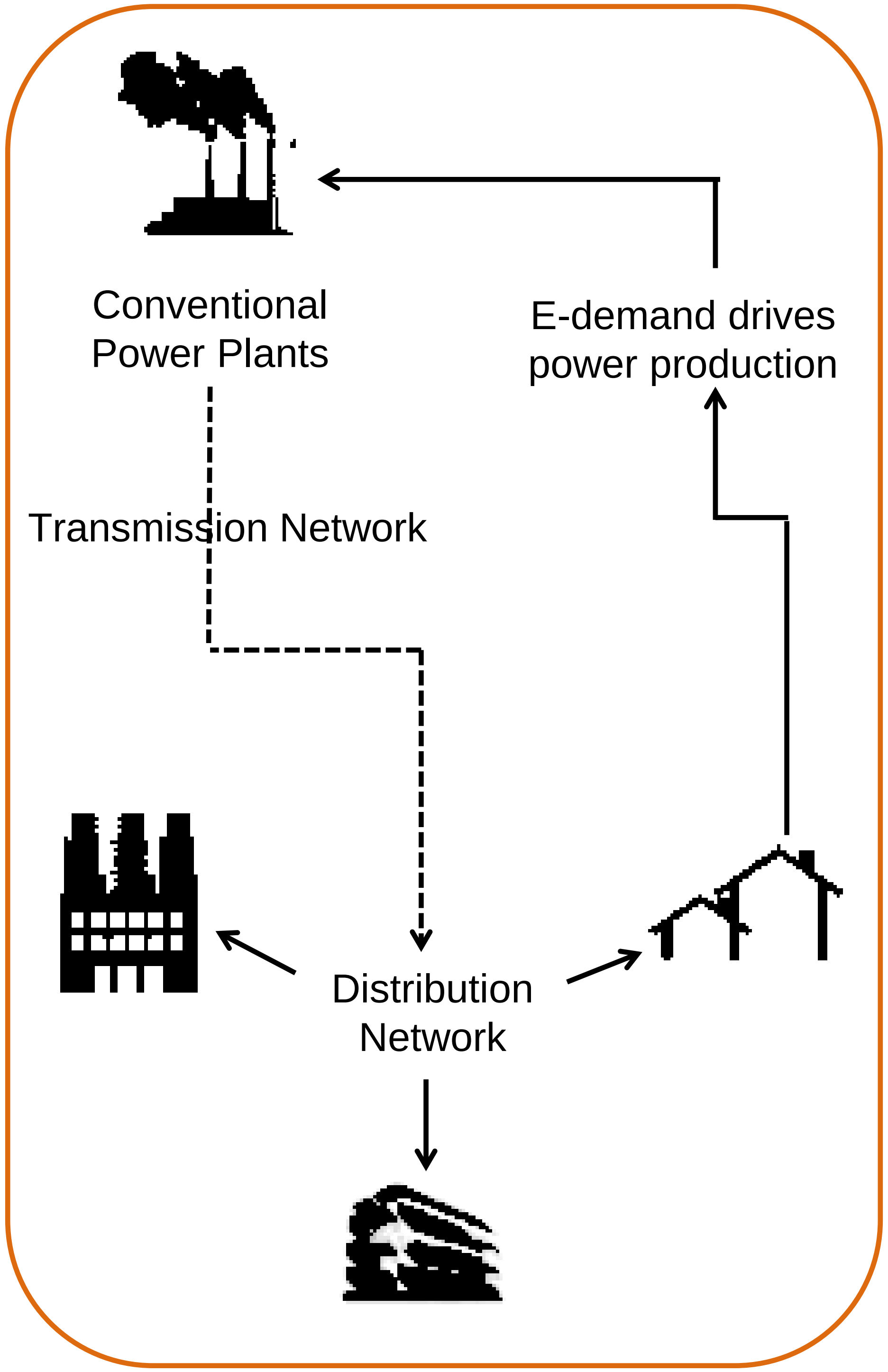
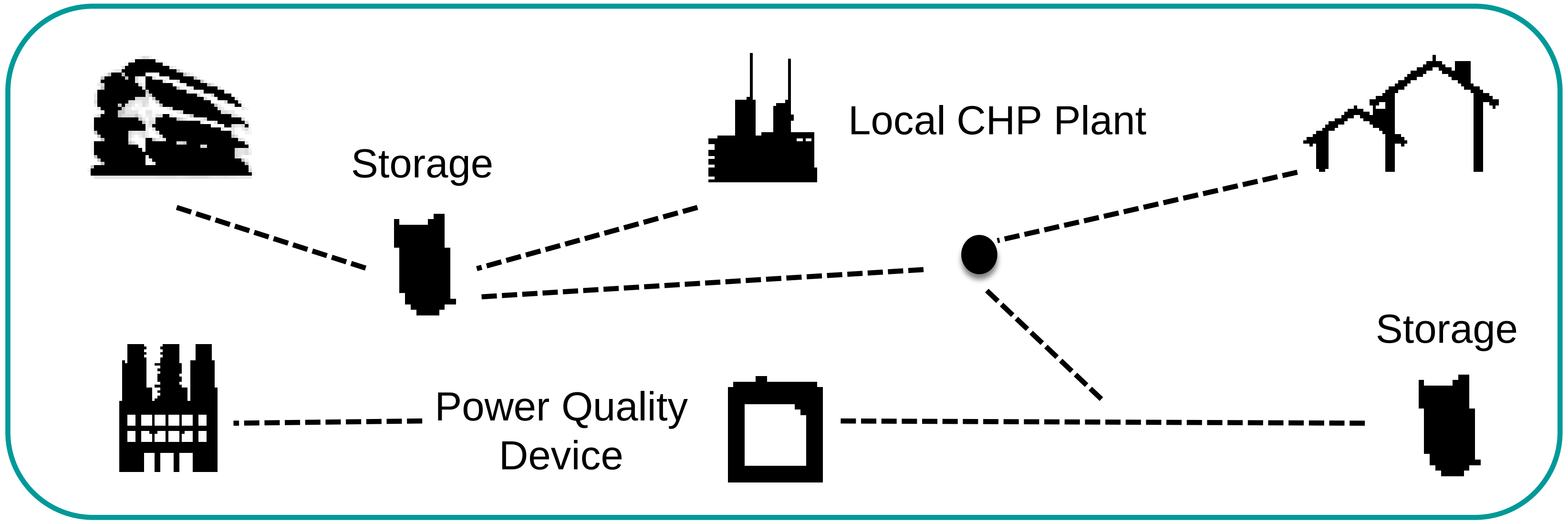
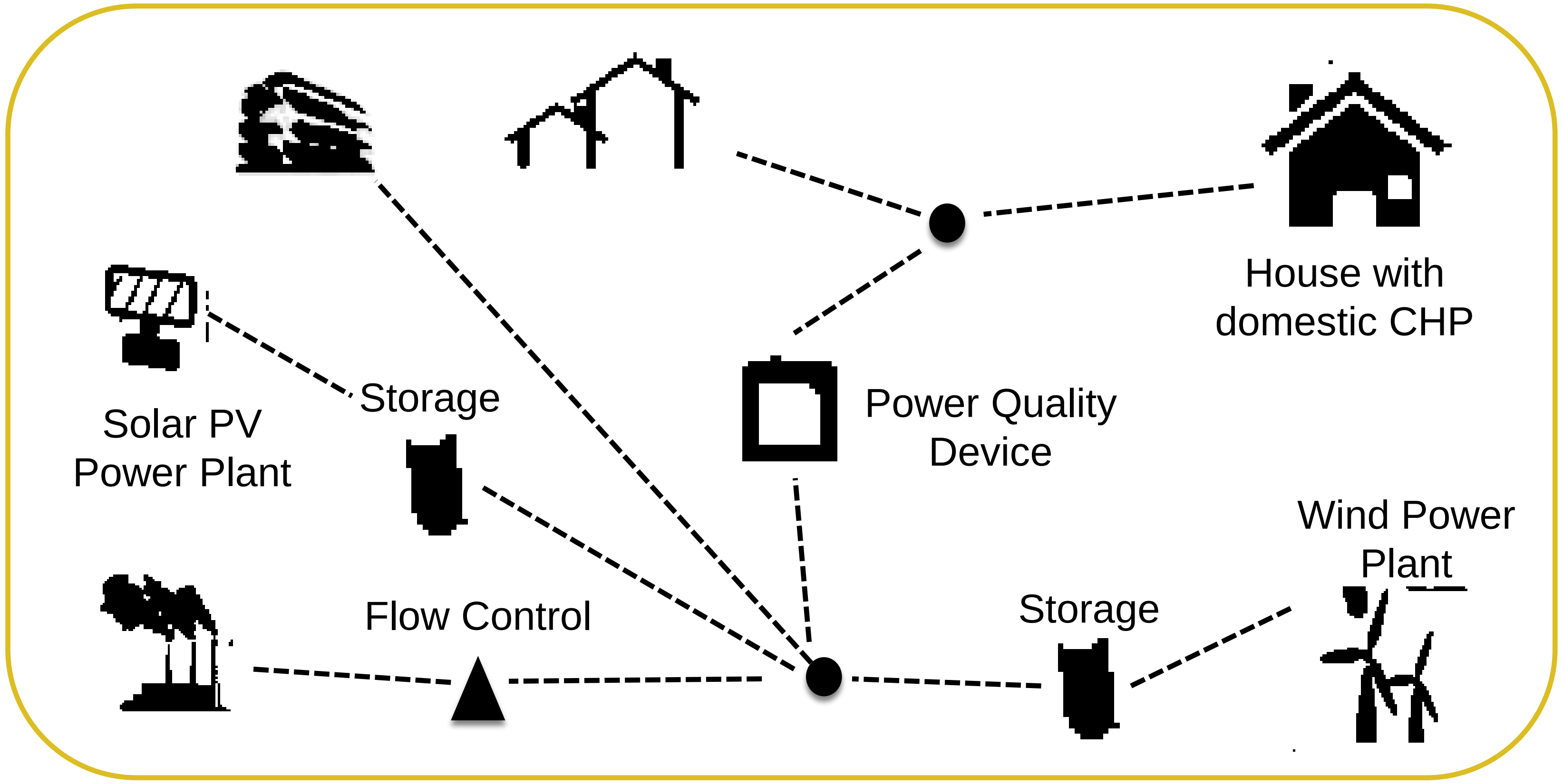
Towards a more distributed energy system

Centralised Generation



De-Centralised Generation





An increasing role for Micro-generation

- ✓ Micro-generation is set to play an ever increasing role in creating new capacity and decarbonising the grid whilst also providing a valuable tool to consumers for reducing their energy bills in comparison to imports from the grid ;

- ✓ Micro-generation technologies could also have a significant role in supporting network management through DSR provision and reducing the levels of the network;

- ✓ The analysis covers growth potential of selected technologies and how they can be deployed most effectively in terms of grid requirements; at the consumer level, the key areas are about maximising returns while minimising impacts on comfort levels;

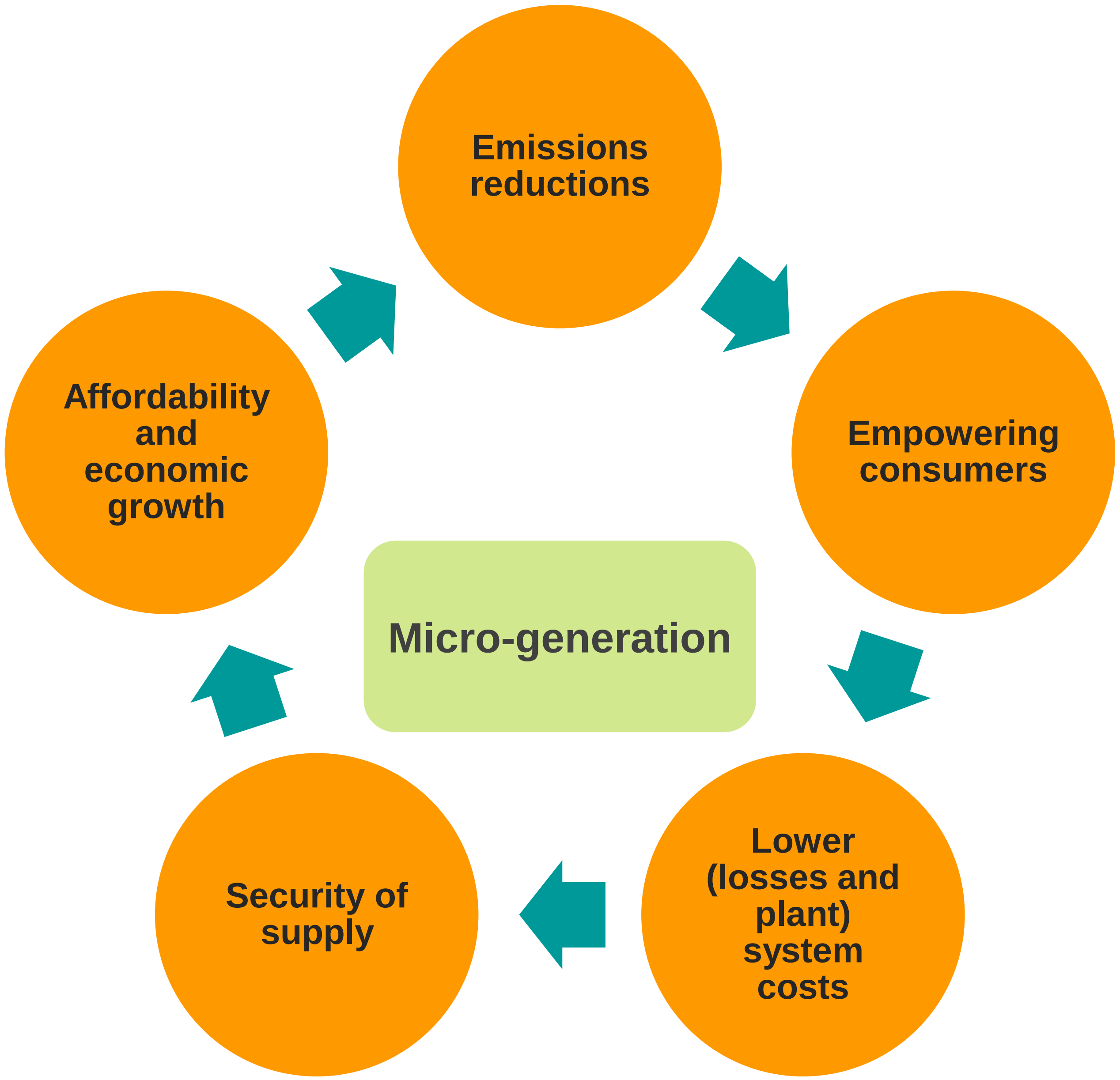


Diagram 1. Micro-generation

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Scenarios

- ✓ A project that was commissioned by the Sustainable Energy Association (SEA) -formerly the MicroPowerCouncil)- and the Electricity Storage Network (ESN) in 2013 highlighted the central role of Micro-generation and the need to introduce half-hourly data from smart meters to support the development of ToU tariffs;
- ✓ The project tested a number of scenarios – developed based on LCNF projects findings to estimate the potential savings to consumers from using micro-generation technologies under a smart grid framework

Scenario	Base case scenario	Static Time of use tariffs	Dynamic Time of use tariffs
Day time	15.2 p/kWh	19.32 p/kWh	11.76 p/kWh
Night time	15.2 p/kWh	14 p/kWh	3.99 p/kWh
Peak time/critical	15.2 p/kWh	40.05 p/kWh	67.2 p/kWh
Relevant LCNF project	n.a.	Northern Power Grid http://www.ofgem.gov.uk/Networks/SGF/work-stream-6/Documents1/Low_Carbon_Networks_Fund_Slides_from_Domestic_LearningEvent.pdf	UK Power Network http://www.ofgem.gov.uk/Networks/SGF/work-stream-6/Documents1/Low_Carbon_Networks_Fund_Slides_from_Domestic_LearningEvent.pdf

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Table 1. Scenarios

Micro CHP technologies

- ✓ Micro CHP technologies (both heat led and fuel cells) are mature technologies; the Carbon Trust estimates that 8 million homes from the UK could be suitable for m-CHP; however, high capital costs remain the main barrier to uptake;
- ✓ under current policy arrangements the domestic technology is eligible to a generation tariff of 13.24 p/kWh and an export tariff of 4.77 p/kWh; consumers are also able to benefit from electricity generated onsite as by-product of heat;
- ✓ It is considered that displacement of the marginal power plant with micro CHP systems could be effective when taking into account that the load profile of the technology closely matches the system profile; hence, replacement of existing boiler stock with micro CHP systems could lead to significant capital, energy and emission cost savings.
- ✓ The existing policy and market arrangements fail to reflect the true value of the technology. **ToU tariffs that proxy the cost of procuring electricity on the wholesale market would be effective in capturing the value of the technology to the GB energy system.**

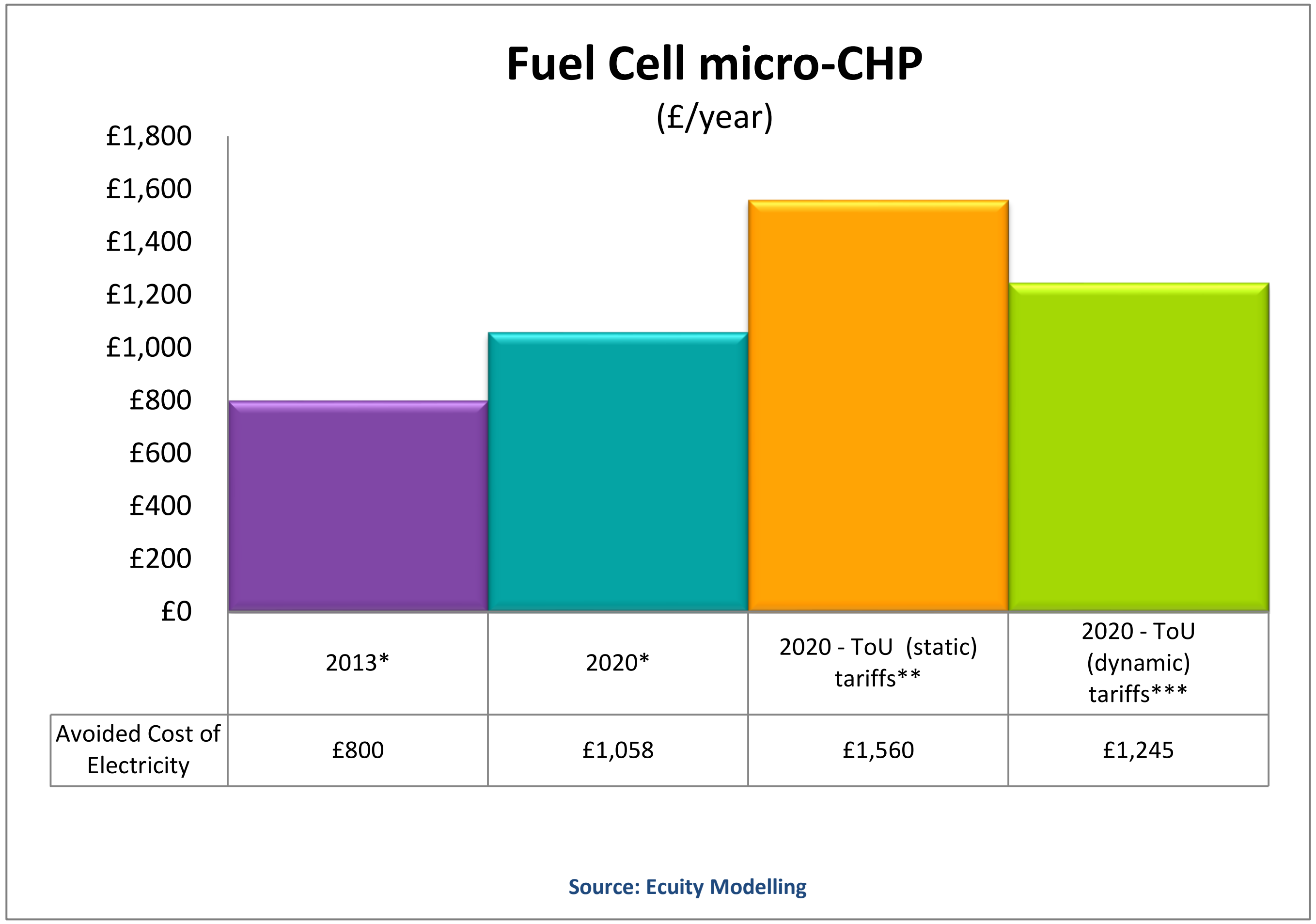

Chart 1. m-CHP scenario analysis

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Solar PV & storage

- ✓ Solar PV notably took off with the introduction of the Feed-in tariff scheme in 2010, starting from approximately 30,000 units at 300 MW at the end of March 2010 to 5 GW milestone at the end of 2014;
- ✓ Under current policy arrangements the technology is eligible to a generation tariff of 13.39 p/kWh and an export tariff of 4.77 p/kWh; in addition consumers also benefit from electricity generated onsite;
- ✓ however when comparing domestic profile (1 and 2) to the typical generation profile – there is a mismatch between timing of generation and consumption where PV generation peaks and demand is at its lowest;
- ✓ This naturally leads to the incentive for consumers to maximise self-consumption of the electricity they generate. Solar PV with storage would enable full self-consumption by allowing consumers to use electricity generated during the day at peak times i.e. when the grid is under stress. **ToU tariffs that proxy the cost of procuring electricity on the wholesale market would be an effective tool to incentivise self-consumption.**

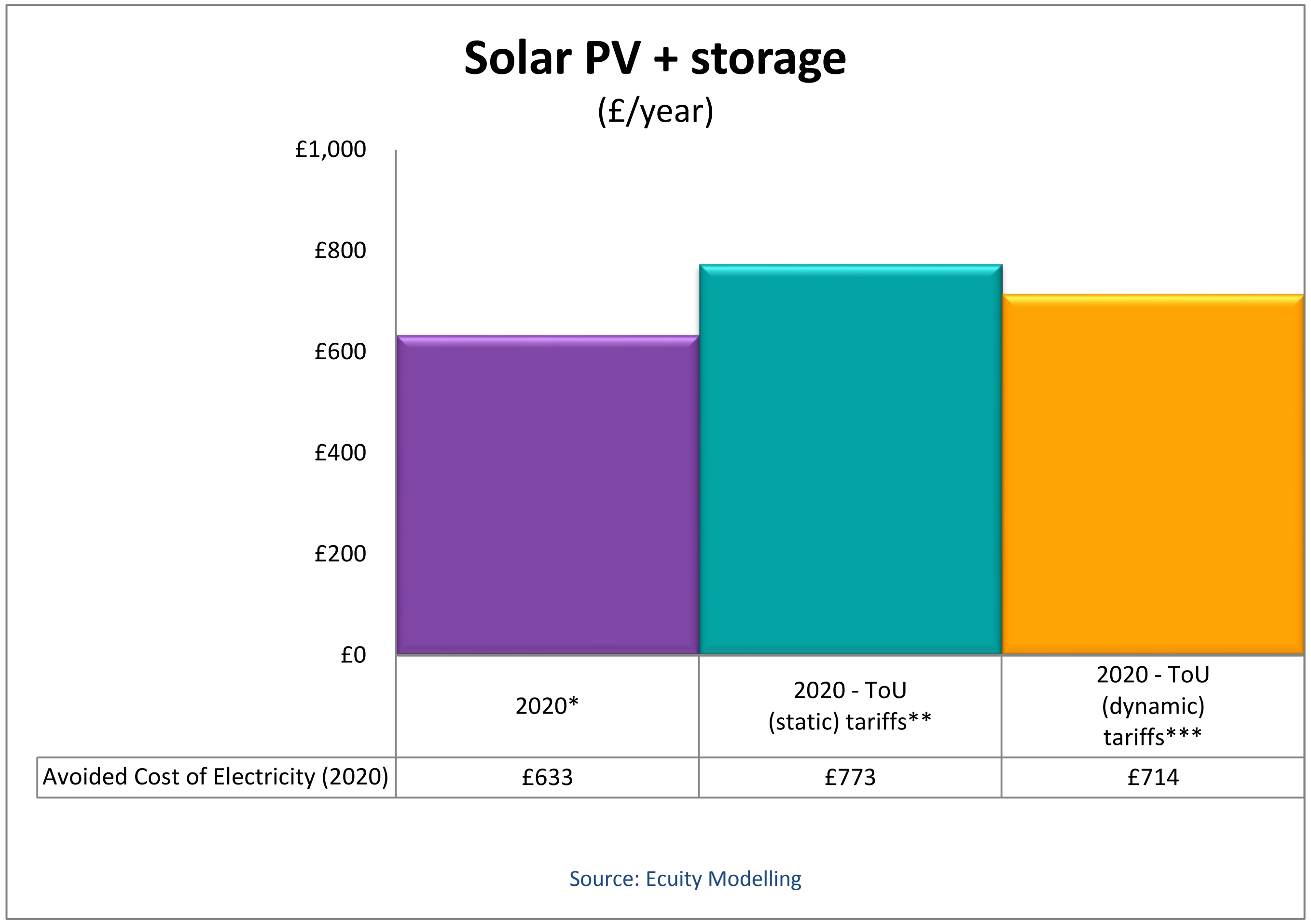

Chart 2. Solar PV + storage scenario analysis

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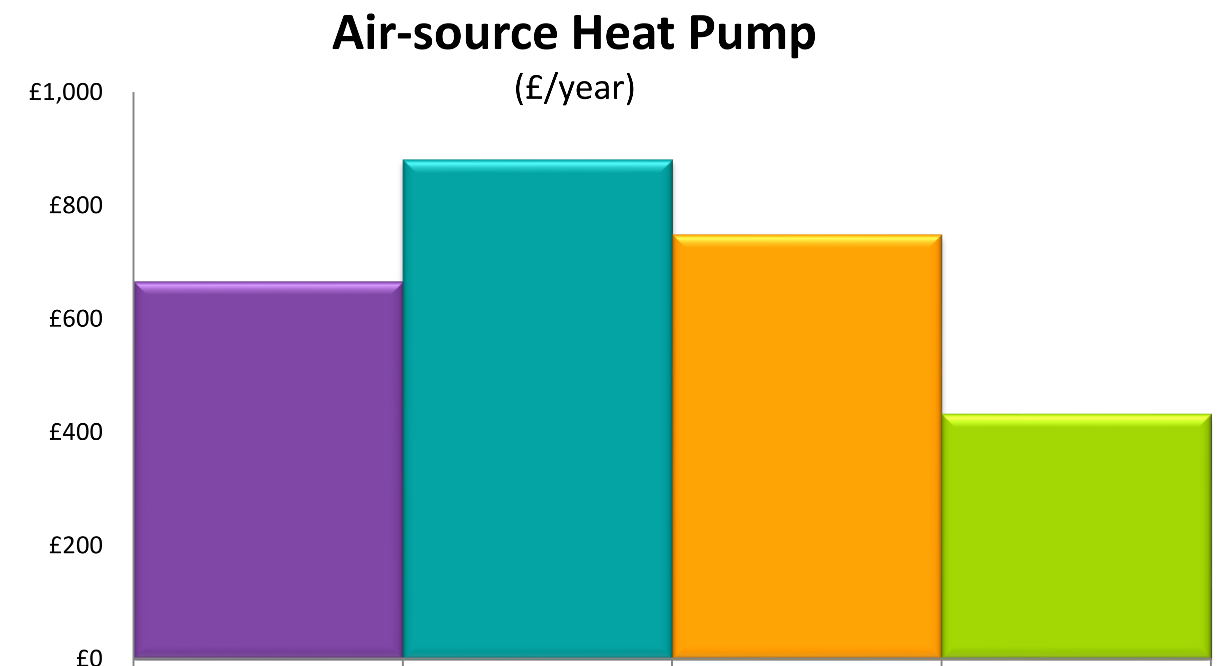
Heat pumps

- ✓ Air-source heat pumps (ASHPs) are highly energy efficient and use a renewable source to produce 2 to 3 units of heat from one unit of electricity; ground-source heat pumps (GSHPs) are the most efficient heat pump technology and therefore optimal source of energy;
- ✓ under current policy arrangements the domestic technology is eligible to RHI payments of 7.2 p/kWh for ASHP and 18.8 p/kWh for GSHPs;
- ✓ Heat pumps “top up” with electricity during the winter months and particularly during times of peak demand; as a result of rising electricity prices the cost of running the technology may increase within the next decade;
- ✓ it is envisaged that “smarter use” of the technology – including smart heat pump controls, thermal storage - could lead to a reduction in energy costs; **ToU tariffs that proxy the cost of procuring electricity on the wholesale market would incentivise smart use of the technology and contribute to reduce the load on the GB energy system.**



	2013*	2020*	2020 - ToU (static) tariffs**	2020 - ToU (dynamic) tariffs***
Electricity Cost	£667	£881	£749	£432

Source: Ecuity Modelling

Chart 3. Heat pumps scenario analysis

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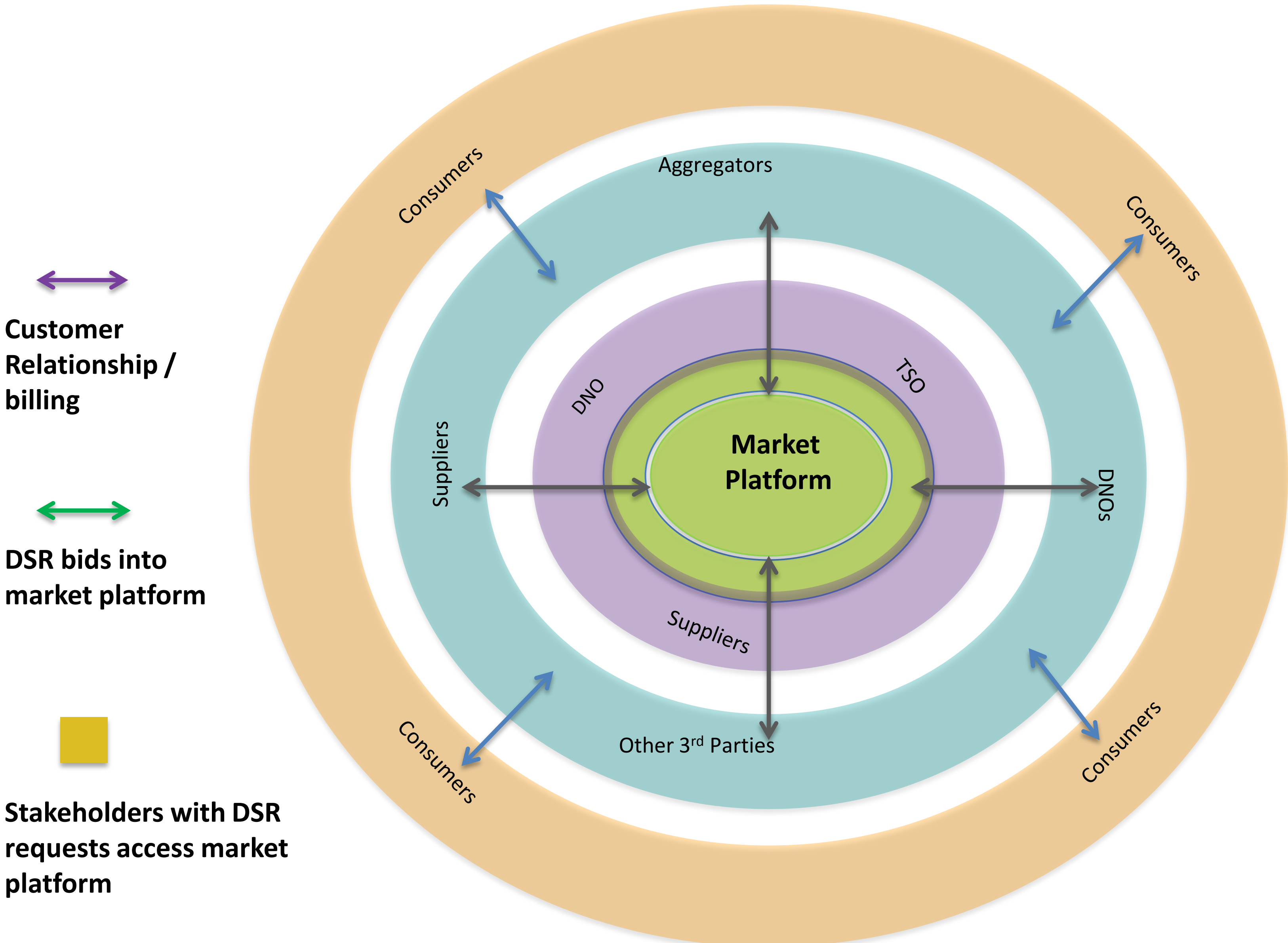
Local energy markets

- With the evolution of arrangements that will come as the necessity for balancing at the local level increases, DNOs are likely to transition to a Distribution System Operator role , as National Grid does for the transmission network.
- To this extent, the effective creation of Local Energy Markets (LEMs) may involve the emergence of new participants such as community organisations or even individuals.
- An investigation into the benefits of LEMs by the consultants, Swanbarton, suggests consumers' energy costs falling by 10% and local producers' revenues increasing by about 50% when storage participates in a local energy market.



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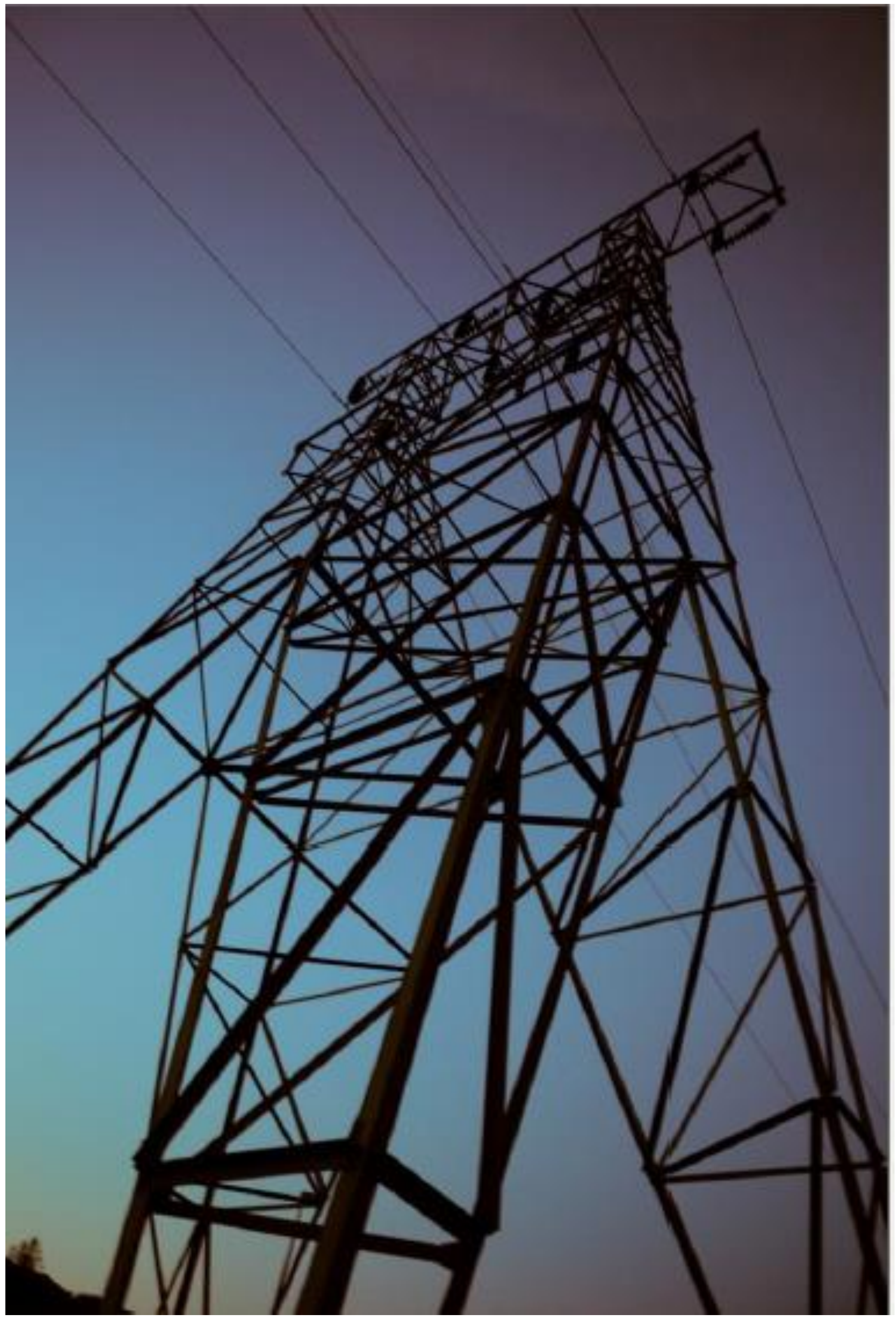
Balancing the energy system

- ✓ The role of aggregators will be key to engaging micro-generation and storage in demand side response mechanisms; flexibility of micro-CHP, solar PV + storage and heat pumps place the technologies in a strategic position in the evolving energy system;

- ✓ Excess electricity generation by a fleet of micro CHP could be sold and delivered to the grid at times when procuring electricity on the wholesale market becomes more costly; conversely, in a situation when the voltage on the grid is too high, a fleet of heat pumps could be employed to absorb the excess electricity on the system; storage devices, both electricity and thermal solutions could play similar role.



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Recommendations & Next Steps

Recommendations

- ✓ Deployment of micro-generation technologies should be encouraged through policy and market mechanisms to ensure there is enough flexibility on the energy system;
- ✓ Retail Market Reform must not restrict Suppliers and District Network Operators (DNOs) capacity to offer Time-of-Use (ToU) tariffs;
- ✓ For Balancing & Settlement, a move to half-hourly settlement would support the introduction of ToU tariffs;
- ✓ DSR should note exclude export from small scale and micro-generation and storage from 'beyond the meter';

Next steps

- ✓ Whole-system cost benefit analysis to estimate the full costs and benefits of integrating micro-generation technologies on the GB energy system [update to SIAM, 2004];
- ✓ Field trials to investigate the impact of introducing ToU tariffs on consumers with micro-generation technologies.

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Appendix- System integration of additional micro-generation

In the SIAM study LV networks were modelled by using some generic data supplied by DNOs. The SIAM study used three load densities: Urban, Sub-urban and Rural, developed by DNOs.

MM's principal conclusions from the SIAM study are: -

- The economic cost of accepting more than 17GW, of micro generation into British networks is comparatively small, and substantially less than the wider benefits that such a level of microgeneration would bring.
- Existing LV networks can, under most circumstances, accept up to 100% penetration of micro generation, provided that certain steps to reconfigure the networks are taken as penetration levels increase. The principal requirement is to modify transformer taps, and this action would only be required once micro generation penetration in a particular locality reached a threshold which might be of the order of 50% in an urban network (PB Power study), but could be as low as 20% in more rural networks or a value approaching 100% in a heavy urban environment.
- Whilst there will be costs of accommodating large levels of microgeneration, these are considerably outweighed by the benefits directly associated with networks – in particular the ability to defer reinforcement costs and reductions in distribution losses.
- With 17GW of micro generation on the power system economic benefits amount to around £1.3bn per annum or £30 per MWh in real terms at 2003 price levels. These benefits fall outside "networks" and primarily consist of a reduced need for centrally connected generation, which arises from avoided capacity, energy and emissions costs. These benefits should also be set against the capital and operating costs of micro generation.

Source: Mott MacDonald [2004]