Response to low carbon network infrastructure inquiry
9 November 2015

1. The Association for Decentralised Energy welcomes the opportunity to respond to the Energy and Climate Change Committee’s inquiry into low carbon network infrastructure.

2. The ADE is the UK’s leading decentralised energy advocate, focused on creating a more cost-effective, efficient and user-orientated energy system. The ADE has more than 100 members active across a range of technologies, including energy suppliers, generators and users. Our members have particular expertise in combined heat and power, district heating networks and demand side energy services, including demand response.

Response summary
3. Infrastructure should be developed with a clear aim – to deliver the best consumer value in the transition to an affordable, secure and low carbon economy. To do so, there are two key principles that should apply to reviewing infrastructure policy and investment:

- We should ensure consumer value by using existing infrastructure more effectively; and,
- New energy infrastructure investments should be considered holistically, as part of the wider energy system.

4. By addressing these two principles, the Government could move towards less wasteful, better value energy, low-carbon infrastructure.

5. Protecting consumers by using existing infrastructure more effectively
   - Support demand response. Demand response enables users to take control of their energy and be rewarded for helping to maintain a stable energy system. Committee on Climate Change analysis identified nearly £7 billion of reduced infrastructure investment costs as a result of seizing demand response in a low carbon energy system. Current policy is failing to tap this value and fails to value avoided infrastructure investment almost entirely.

   - Drive network productivity. Analysis of DECC data reveals that power network efficiency has improved only 2% since 1990. If UK transmission and distribution losses were equivalent to those in Germany\(^1\), the best in Europe, customers would save £605 million a year, the equivalent of £23 per household\(^2\). However, regulators’ funding to cut network losses is only £6.4m a year over the next five years.\(^3\)

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\(^1\) The World Bank data, based on the International Agency Statistics (OECD/IEA) 2012. Electric power transmission and distribution losses in Germany represent 4% of the electrical output, and it is 7.9% for the UK and 7.1% for Denmark
\(^2\) Values each lost unit of electricity at the wholesale market price.
• **Retain and build on the key principle of ‘cost reflectivity’** – the prices charged to users and generators should reflect the costs they impose or reduce. As the energy system becomes more decentralised, there are key roles for locational charges and retaining the value for not using the power transmission system, known as the Embedded Benefit.

### 6. Building new energy infrastructure to deliver best consumer value

- **Invest in heat infrastructure to capture wasted energy.** The UK power generation system wastes enough heat for every home in the UK. District heating networks in densely populated areas are an ideal way to collect waste heat and move it to the points of use. This cuts unnecessary energy waste, boosts security of supply and reduces emissions.

- **Look to today’s energy storage solutions.** Energy users want energy services (mobility, warmth, computing), not the energy itself. Energy storage solutions should focus on the services needed. Thermal storage is far less costly than power storage but more expensive than fuels such as coal. Holistic analysis of system energy needs will ensure we build the right type of energy storage rather than being enthused with the latest technology.

- **Bring energy production and use nearer together.** This cuts network losses and enables wasted heat from power generation to be captured. Combined heat and power is up to 90% efficient compared to 50% for normal power generation, but needs to be located near to points of demand, such as industry.

### Full response

7. This is a critical inquiry. The UK needs infrastructure fit for purpose. This infrastructure should be developed with a clear aim - to deliver the best consumer value in the transition to an affordable, secure and low carbon economy. The pursuit of value should be unrelenting, as wasted money costs consumers and taxpayers.

8. To do so, there are two key principles that should apply to reviewing infrastructure policy and investment:

   1. **We should control consumer costs by using existing infrastructure more effectively** to deliver a better value and more secure energy system. There are major infrastructure opportunities to cut waste from the energy system that remain untapped.

   2. **New energy infrastructure investments should be considered holistically,** as part of the wider energy system. There are major interactions with potential conflicts and synergies between heat, power and transport. To ensure the best value for energy users, the synergies need to be understood and exploited and conflicts mitigated. This cannot be achieved with the current siloed approach to energy policy.

9. By addressing these two principles, the Government could move towards less wasteful, better value energy low-carbon infrastructure. We have provided more detail on how to do so below.
Protecting consumers by using existing infrastructure more effectively

10. The Government should seek to maximise the efficient use of existing infrastructure as a way of delivering a better value and more secure energy system. There are major infrastructure opportunities to cut waste from the energy system that remain untapped.

How engaged customers lower network costs through demand response

11. As variable renewable generation such as wind increases, the need to manage the system to ensure that power generation and demand are in balance at all times becomes more challenging and costly.

12. One option is to build more generation that can sit and wait for signals to generate and more lines to carry that power. This has both cost impacts (assets waiting to operate in a just-in-case basis) and environmental impacts - more network cables and more emissions when operating.

13. While some of these new standby generation assets may be needed, there are substantial opportunities where industry and the public sector can use their own onsite generation and electricity demand to help manage the system. This 'demand response' allows energy customers to participate in the energy system and be rewarded for the value they provide. The value goes to energy customers rather than to energy generators and therefore helps British business to be more competitive and see energy as a revenue opportunity as well as a cost.

14. Increasing the use of demand response can have a significant impact on infrastructure costs by reducing the maximum electricity demand (through moving demand and increasing onsite generation). This demand response also benefits the wider UK economy by getting more out our existing infrastructure. A 2014 Imperial College and Element Energy study for the Committee on Climate Change found that by deploying smart voltage regulation and demand-side response around on distribution networks, £5 billion of reinforcement costs to enable decarbonisation could be avoided. This is in addition to £300m in avoided transmission infrastructure costs.

15. A September 2015 analysis of the UK’s demand response potential produced for DECC showed that there is currently more than 18 GW of peak demand which could participate in demand response, given the right market and regulatory framework. This research found

- A peak demand of up to 11 GW of Industrial and commercial demand available for demand response from a range of sources, including drives, pumps and motors.
- An estimated 7GW of demand response opportunities in domestic properties today which rises to 14GW in 2035 as heat pump and electric vehicle use increases.
- Potential for another 7 GW of distributed grid level electrical storage by 2035.

16. Much of the opportunity in the industrial and commercial sectors is available to access today, and a number of companies are already active market participants. However, as noted, the potential is significantly larger and action is needed to unlock it. To access this potential, there is a need to ensure:

- Demand response is can compete equitably with generation in the Capacity Market;
- The value to the network of demand response services is available to demand response providers,
• That the necessary reform of the network regulations and governance is made a key priority for both Ofgem and the Government and that this be approached with a clear focus on enabling smaller scale demand side to participate equally with traditional technologies.

Drive network productivity
17. UK power network efficiency has improved by only 2% since 1990. If UK transmission and distribution losses were equivalent to those in Germany\(^4\), the best in Europe, customers would save £605 million a year, the equivalent of £23 per household\(^5\). However, regulators’ funding to cut network losses is small at only £6.4m a year over the next five years.\(^6\)

18. There are opportunities to get more from our networks by reducing network losses when the system is 'congested'. Yet Ofgem's assessment of our energy system under the Energy Efficiency Directive did not consider any new proposals or strategies to make better use of these services.

Retain and build on the principle of 'cost reflectivity'
19. Key to keeping costs low for consumers is to ensure 'cost reflectivity’ that is the prices charged to users and generators should reflect the costs they impose or reduce on the system. Without such signals there is a significant risk that overall costs for consumers will rise. There are two areas where cost reflectivity is a current issue:

Locational charges
20. Electricity transmission charges contain a locational element to recognise that customers in different locations use different amounts of the transmission network, and therefore impose different costs on it. This cost reflective approach promotes efficient use of the network by larger users, for example, by providing a signal to generators that locating close to their customers requires less transmission network to be built, cutting waste from the energy system and reducing costs for consumers.

21. Both the Competition and Markets Authority’s provisional findings and an Ofgem March 2015 letter recognised there are options to improve locational signals in the market through Balancing Services Use of System (BSUoS) charging, losses, transmission charging and the separation of the market into different bidding zones ('market splitting').

22. Therefore, any changes to market pricing should increase, not decrease, these locational signals if we are to improve on the system’s cost-effectiveness.

The impact of growing distributed generation capacity
23. Generation is becoming more local, with increasing amounts on the local distribution networks. National Grid estimates there is approximately 15 GW of distributed generation in 2015, growing to between 25 GW and 40 GW by 2040. This revolution is empowering consumers and giving them greater control over their energy bills as well as cutting losses from transporting energy over long distances.

24. As distributed generators do not use the transmission system they do not pay for its use. This recognition is termed the ‘Embedded Benefit’ and allows generation to avoid the cost of Transmission Network Use of Systems (TNUoS) charges. National Grid reviewed the

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Embedded Benefit in 2013 and decided to retain the Embedded Benefit following a clear response from every major energy association that the proposals would make the energy system less cost-reflective and risked overall higher costs for consumers.

25. In those cases where increasing local generation causes electricity to ‘spill upwards’ onto the transmission networks, new infrastructure investment may be needed. It is right for National Grid to ensure cost reflectivity extends to this issue, but it must implement changes so they recognise the future more actively managed local network. As such it will be important for National Grid to consider the future distribution system in its consultation.

26. Currently National Grid does not value the impact of other changes at the DNO level, such as: more active management, demand response, including and load shifting. Ofgem recognised this year that to achieve a more flexible, responsive system it will be important to see Distribution Network Operators transition become Distribution System Operators.

Building new energy infrastructure to deliver best consumer value

27. New energy infrastructure investments should be considered holistically, as part of the wider energy system. There are major interactions and potential conflicts and synergies between heat, power and transport. To ensure the best value for energy users, the synergies need to be understood and exploited and conflicts mitigated - this cannot be achieved with the current siloed approach to energy policy.

Invest in heat infrastructure to capture wasted energy

28. Any time we make or use energy, we lose some of it as heat. Power stations, the industrial sector and cities like London all waste heat, and together they waste more heat than is used by every home in the UK. By building heat infrastructure, also known as district heating, in densely populated areas we can collect waste heat and move it to the points of use. It is by investing in this form of low carbon infrastructure that we can cut unnecessary waste from the energy system and reducing emissions at the same time.

29. The power sector emits more than 271,000 GWh of waste heat, the industrial sector more than 8,000 GWh, and the city of London more than 12,000 GWh. If captured, and supplied just some of this through heat networks we could save £4.2 billion, the equivalent of £168 per household. It would also reduce enough carbon to be the equivalent of taking every one in five cars off the road.

30. Analysis by a number of research and Government bodies, including Stratego, the Energy Technologies Institute and DECC, show district heating is a key form of cost-effective network infrastructure as part of the low carbon network transition. With the support of the Government’s Heat Network Deployment Unit (HNDU), more than 150 local authorities are now investigating local heat infrastructure investments, with a value of more than £1.6 billion. These innovative schemes capture waste heat from power stations, industrial sites, and tube stations to make our energy system more productive and alleviate fuel poverty.

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7 This is termed an ‘exporting grid supply point (GSP)’
11 ADE analysis using publicly available data. Data is for whole economy not household savings – the data are used an indicator of scale
31. However, there is not yet a clear strategic policy to develop and deploy this low carbon heat infrastructure. Unlike gas and power networks, heat networks do not have an investment and regulatory framework underpinning them. The absence of such a framework excludes potential investors as the risks around district heating investment are considered to be significantly higher than for other network infrastructure projects. Government can take steps to reduce investment risk for this network infrastructure and secure larger, better-value schemes into development at low cost to taxpayers.

**Look to today’s energy storage solutions**

32. A systems approach to new infrastructure can ensure that we are able to take advantage of synergies between heat and electricity, specifically in securing cost-effective energy storage. Fossil fuel systems, such as coal and gas, can store significant amounts of energy, and a move to a more renewable system will require that such existing energy storage to be secured in other ways.

33. Thermal stores are a large version of a household hot water tank, and heat is cost effective to store. Thermal stores can reduce the cost of balancing the electricity system, and heat network efficiency. These both cut consumers’ bills. When the electricity grid is over-supplied (e.g. high wind and solar), instead of paying turbines to stop thermal stores can turn on electric boilers absorb the electricity and release it as heat when customers need it. When the electricity grid does not have enough power, a heat network or home can use highly-efficient combined heat and power to generate electricity and store the heat for when users need it.

34. Analysis by the UK Energy Research Centre (UKERC) found that heat networks supplying 100,000 heat customers with large-scale heat pumps could provide the equivalent of 8 GW battery storage. Their analysis also found that heat storage costs as low as £25/m$^3$, which translates to the equivalent of £31/MW of electrical storage capacity. European analysis has found that the price differential between gas and liquid storage; thermal storage; and electricity storage is 1:100:10,000. This means that while thermal storage is 100 times more expensive than gas and liquid storage, it is around 100 times cheaper than electricity storage.

35. Despite being available today, thermal storage struggles to participate in an electricity market designed for large, centralised generators. Such challenges are also faced by battery storage. The actions necessary to unlock this potential storage technology are similar to those recommended earlier for the wider demand response market.

**Bring energy production and use nearer together**

36. Currently 54% of the energy used to produce electricity is lost by the time it arrives at a UK home or business. This lost energy is worth £9.5 billion a year to the UK economy. Put another way, it is the equivalent of £354 per household. It also represents carbon emissions equivalent to every car in the UK.

37. Combined heat and power (CHP) is a form of energy production infrastructure which produces energy close to customers, providing them with both heat and electricity. By producing electricity closer to its demand, CHP cuts network losses. If half of current

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centralised thermal generation was instead directly connected at the distribution level near demand, the avoided transmission losses would save energy users £135 million annually\textsuperscript{16}.

38. CHP also enables wasted heat from power generation to be captured and used by manufacturers, businesses and homes. CHP is up to 90% efficient compared to a maximum of 50% for normal power generation, but needs to be located near to points of demand, such as industry. The cost effective potential for CHP is more than three times the current capacity\textsuperscript{17}, and the potential captured heat could be worth more than £2 billion a year\textsuperscript{18}.

39. Currently the Capacity Market incentivises new power generation infrastructure that is largely inefficient and does not capture its heat. In the 2014 Capacity Market auction, nearly 2.6 GW of new generation included only 3 MW of new CHP capacity but about 800MW of gas and diesel engines which waste their heat. With limited new CHP capacity participating in the 2015 auction, results are not likely to differ significantly. Reforms need to be made to the Capacity Market to better unlock efficient generation infrastructure, including CHP.

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\textsuperscript{16} See lesswastemoregrowth.co.uk/report
\textsuperscript{17} Ricardo-AEA, 2013. Projections of CHP capacity and use to 2030. Report for DECC. Cost effective potential based on a discount rate of 15% over 10 years.
\textsuperscript{18} See lesswastemoregrowth.co.uk/report