The Voice of the Networks

Energy Networks Association

Open Networks Project

Work stream 4: Whole Energy System

Final 2019 Report

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Document Control

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1 Work Stream 4 Overview

ENA Open Networks Work Stream 4 ("WS4") was created in response to stakeholder feedback in early 2019. The feedback supported the development of the Open Networks Project thinking across Transmission and Distribution networks in the electricity sector and suggested its expansion across the whole energy system.

Upon creation, WS4 became the only working group where all GB energy network companies actively discussed interactions between gas and electricity networks. Groups already existed to discuss regulatory price controls or overall governance of ENA as an organization, however the only other forums for cross-fuel working were specific innovation projects involving a small number of networks, looking at specific issues.

The experience of the first year of WS4 has highlighted that whole system thinking across gas and electricity network companies and their stakeholders was less developed than expected. The workstream has made significant progress in building the foundations for whole system thinking and working in future, through activities such as agreeing definitions and frameworks for tackling whole system challenges. It has also identified and explored a small number of tangible, value-adding opportunities, which provide the benefit of immediately putting in place the foundations for collaboration being built by WS4.

1.1 Final Report

This report is the final report from the work undertaken in of 2019. It outlines the method and approach taken to developing whole energy systems outcomes in the Open Networks Project, as well as opportunities for improvement identified by the workstream and the next steps for 2020.

WS4 attracted a broad range of stakeholders and network company attendees for the initial meetings while the scope and plan were built. Once the scope was confirmed through governance channels for both gas and electricity and tested with the Open Networks Advisory Group, work stream membership stabilized and focused upon the confirmed work products.

1.2 Purpose and scope

The purpose and scope of WS4 was agreed by the Open Networks Steering Group and Gas Futures Group in April 2019.

The purpose of WS4 was shaped with stakeholders from industry, Ofgem and BEIS. Key elements of the purpose were:

1. Explore the presumed consumer benefit[1] in whole system thinking.
2. Explore the challenges for network companies working across gas and electricity.
3. Use a focus on near term, tangible issues to:
    a. Deliver tangible benefits to consumers
    b. Pave the way for further whole system work to address long term questions such as the decarbonisation of heat and transport, and the effects of power to gas on the energy networks.

The scope was agreed in line with the above purpose:

[1] See appendix for more detail on the definition of consumer benefit used by WS4

1. **"Whole system" was interpreted as interactions between the gas and electricity networks[2].**
    - Broader whole system interactions such as transport, water, waste were noted and it was agreed that these would be considered but not as a core focus.
    - This relatively narrow definition for whole system was chosen to bring focus to the group's work, as well as to leverage the available resources of ENA members in the working group.
2. **Focus on near term value from possible changes to existing activities and processes.**
    - Long term thinking and modelling of whole energy system futures is a crowded space, but actual cross-fuel processes as business as usual (BAU) are rare.
    - Meets the purpose of delivering tangible benefits to consumers.
    - Existing interactions between gas and electricity networks provide real-world case studies for how cross-fuel working can be approached in the future as whole system thinking becomes more complex and more important.
3. **Specific exclusions to scope (due to existing forums or need for specialist knowledge).**
    - Cyber security was evaluated as being important but requiring specialist skillsets, which were not available to the workstream
    - Interactions between transmission and distribution systems for a single fuel were excluded, as forums already exist for this work.
    - Incident management and response already have industry processes across fuels.

Stakeholder feedback through the year has continued to be supportive of this scope, in particular the aspect of focusing on near-term examples. Stakeholders agree that while there are larger, more exciting and more disruptive issues to focus on in the longer term, such as the impacts of power-to-gas and the impacts of decarbonizing heat, the focussed remit of WS4 on immediate, cross-fuel activities is fundamental to any future whole system opportunities.

1.3 The approach and work products

Due to the exploratory nature of the work, WS4 took a hypothesis-driven approach rather than a problem-solving approach. This was to focus work on exploring and proving consumer benefit in potential opportunities, before recommending more significant investment, rather than trying to solve problems which may or may not deliver benefit.

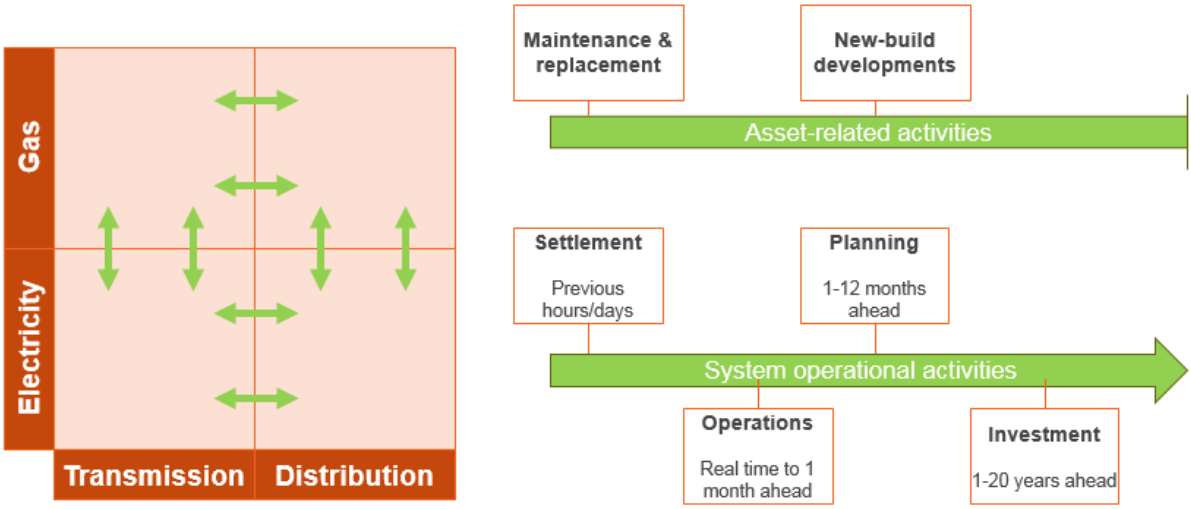
An example of this difference is:

> *Problem-solving: How can we improve demand forecasting (by sharing data between control rooms)?*
>
> *Hypothesis-driven: The benefit to consumers in gas and electricity network companies sharing operational forecasting data significantly outweighs the cost of doing so.*

[2] This interpretation aligns with the definition of "whole energy system" in this report's recommended set of definitions

Brainstorming sessions with WS4 participants generated potential hypotheses to pursue[3], using the following framework to categorise ideas across the whole system:

- Real time operations and forecasting timeframes (real time to 1 month ahead)
- Planning timeframes (1-12 months ahead)
- Investment timeframes (1-20 years ahead)
- Settlement timeframes (after real time)
- Asset development
- Asset maintenance and replacement



Thinking evolved over initial scoping sessions before landing on **four work products**, one for each of the following categories:

1. Customer connection processes – a consistent and joined up approach to network connections across all networks.
2. Real time operations and forecasting – sharing data to improve demand forecasting for gas generation customers and improve resilience planning for electricity networks.
3. Planning timeframes (1-12 months ahead) – a more robust and cross-fuel approach to outage planning.
4. Investment timeframes (1-20 years ahead) – consideration of network investment options across both gas and electricity.

These four products were scoped at a high level[4] before the decision was made to focus on products 2 and 4. This decision was made due to limited capacity from key individuals as they were contributing to other Open Networks workstreams and RIIO2 programmes and to ensure a focus on delivery with a tight scope.

[3] See appendix for summary of brainstorming session outputs
[4] See appendix

The current level of change across the energy industry is significant, with programmes such as RIIO2 for Gas and Transmission companies, upcoming ED2 price controls and significant code review updates, and this influenced the work being undertaken by WS4. However, given the multi-disciplinary nature of WS4 membership, it was fairly straightforward to keep the work stream aligned with these changes. Wherever possible, WS4 proactively reached out to join up thinking with other pieces of work to ensure a consistent approach and minimal duplication of work. For example:

- RIIO2 programmes for all transmission companies and gas distribution companies required whole system thinking and activities in their business plans. WS4 connected with the Ofgem leads on RIIO2 whole system thinking and ran a workshop to agree a common definition of whole system and to draw out issues and uncertainty regarding the whole system in the RIIO2 process.
- The Energy Data Task Force completed its work in June 2019 and the focus and recommendations of the EDTF were shared with and adopted by WS4 in relation to data sharing between network companies. Gordon Graham from the Energy Systems Catapult had a core role in the EDTF work and kept WS4 aligned with this as a member of the work stream.
- Other Open Networks workstreams have relevant cross-over with the WS4 products. WS4 ensured that its membership included representatives from work stream 1B Product 1 (relevant to WS4 work on investment planning timeframes) and work stream 1B product 3 (relevant to WS4 work on operational data exchange) to ensure joined up thinking.
- WS4 membership included regulatory specialists, who helped ensure the scope avoided duplication with the Significant Code Review (SCR) of network access and forward-looking charge arrangements. The SCR includes:

    - a review of the definition and choice of access rights for transmission and distribution users.
    - a wide-ranging review of distribution network charges (Distribution Use of System (DUoS) charges).
    - a review of the distribution connection charging boundary.
    - a focused review of transmission network charges (Transmission Network Use of System (TNUoS) charges).

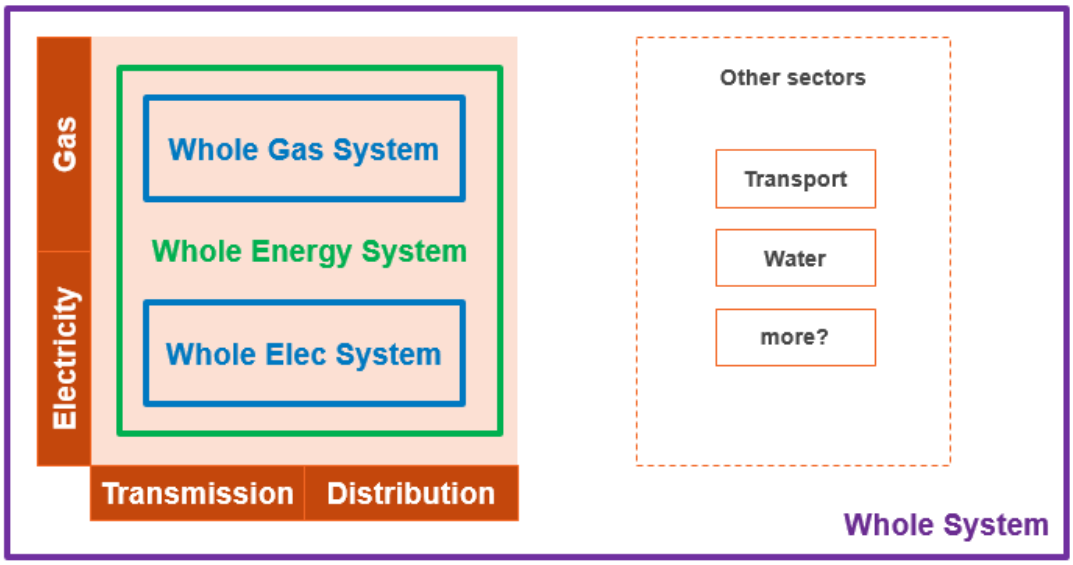
    WS4 agreed that the specialist skillsets required for work in this area were best deployed on the SCR rather than being included in the scope for this work stream.

1.4 Building the foundations for whole system thinking

WS4 started from a low base of shared knowledge and has explored a broad range of challenges regarding cross-fuel opportunities which may deliver value to consumers. While discussing the two, prioritised, work products, general recommendations were also identified which would help to strengthen the foundations of whole system thinking:

1. Encourage existing groups to include more cross fuel representation in order to foster discussion between gas and electricity network companies in GB. **We recommend that a core activity of WS4 continues to be horizon scanning and reviewing Whole Energy System projects, in order to "join the dots" on thinking and work where this can bring consistency and add value to the consumer.**

2. Build a common understanding of vocabulary used across gas and electricity networks, starting with an agreed definition of "whole system" across the energy industry.
    a. **We recommend using the set of definitions for whole system below**, and should be used when discussing or making significant decisions which may impact development, or operation of energy systems, and which have a direct interaction with the gas or electricity networks in GB. It is proposed that these be used in the "Whole System CBA" work proposed for the work stream in 2020.



System	Included sectors	Examples for application
Whole Electricity System	ESO, ET, ED, IDNO	Network investment methodology, codes and markets
Whole Gas System	GT, GD, IGT	Network investment, codes and markets
Whole Energy System	ESO, ET, ED, GT, GD, IGT, IDNO	Building a whole system CBA for regulated networks
Whole System	All utility providers, waste, transport, heat	Exploring the impacts and interactions for wider stakeholder audiences, policymakers

    b. **We recommend the creation of a glossary for working across the Whole Energy System to support clear communication and consistency of thinking.** The work stream found this to be a fundamental need through its work, with terms such as "Real time forecasting" holding different meanings for different sectors (this example can refer to forecasting events four hours ahead of real time in electricity networks, but up to a day ahead in gas

networks). This glossary could be achieved through extension of the existing Open Networks glossary to include gas network terms.

3. Ensure that regulated businesses have a clear and consistent approach to making investment decisions across the whole energy system for the benefit of consumers.
    - Whole system investment by regulated network companies can be undertaken if there is a net benefit to the consumers of that sector (e.g. gas networks may invest for whole system and electricity system benefits, as long as there is a net benefit to gas consumers).
    - If there is not a net benefit to the consumers of that sector then then there is a requirement for at least some element of the cost to be covered by other networks who benefit from the investment (via DRS), or for the outcome of the work to be transferred to a more appropriate network company (via CAM)
    - An understanding of costs and revenue mechanisms across different sectors will be needed in order to administer a CBA (cost benefit analysis) process consistently and effectively.
    - As with existing single-fuel investment decisions, a varying threshold for investment/spend decisions should be used, dependent on the level of investment required.
    - **We recommend the development of a Whole Energy System CBA for investment decisions so that it accounts for benefits to other fuel users. This would help to unlock whole system investment and cooperation.**

4. Broader dimensions of whole system thinking such as local, regional and national considerations also need to be taken into account in order to take optimal decisions. **Our recommendation for Product 4 of this work stream pursues this concept further.**

2 Product 2: Real time operations and forecasting

2.1 Introduction

Product 2 was approved to proceed by the Open Networks Steering Committee on 18th April 2019. The aim of this product is to investigate potential benefits to customers and networks, realised by increased coordination and information sharing about real-time activities between gas, electricity and other relevant network operators.

2.2 Scope

The scope was defined to include a review of operational processes for real-time and day ahead operations. This builds on the work done on data exchange in WS1 and the Offtake Arrangements Document for gas and exploring opportunities for sharing existing best practice as well identifying opportunities for more data sharing across networks.

It was agreed that the focus would be on the next 5 years in order to prioritise quick wins, whilst also considering future-proofing where possible. Future proofing may include the ability to adapt to new load types being connected to gas and electricity networks as well as new commercial and market arrangements which influence user behaviour.

The decision was taken to specifically exclude cyber and incident management as well as the coordination of maintenance and street works as these are areas already considered more widely via different groups (e.g. E3C).

The key opportunities identified at this stage are focused on gas generation sites, having a key and direct linkage between gas and electricity networks. Any processes developed for these sites could then be adapted for use at other key sites, which link electricity and gas networks (including power-to-gas).

- Opportunity 1 – **Improved data sharing**
  Is there an opportunity to share actual flow and notification data in a better way to improve the visibility and understanding of system operators across the whole system which impacts their roles, and therefore increasing their efficiency and the benefit which they deliver to consumers.

- Opportunity 2 – **Share information on network constraints**. Constraints on the gas and / or electricity network might impact a site's ability to flow, for example in the case of flexible generation or the production of hydrogen for gas grid injection. This information could be shared between control centres to minimise disruption and to improve harmonisation.

- Opportunity 3 – **Share short term forecasting.** WWU are considering forecasting power generation requirements (within day and day ahead), for example based on wind generation availability. Other control centres may have similar requirements, in which case joint systems / processes would be an efficient approach

Other opportunities have been identified during the development of Product 2 including facilitation of new markets e.g. arbitrage for hybrid heating systems, although the timescales are likely to be outside the scope of the current work.

2.3 Team members

Product 2 was supported by a range of network and non-network participants as follows:

Name	Company
Ali Ahmadi	UKPN
Jeremy Caplin	Elexon
Sumit Gumber	NG (ESO)
Mark Herring	NG (SO)
Harjinder Kandola	NG
Ryan Kavanagh	WPD
Neil Morgans	NG (ESO)
Dave Adlam	Cadent

Name	Company
Sharon McGuffie	WPD
Ian Povey	ENWL
Flo Silver	OFGEM
Keith Owen	NGN
Colin Thomson	SGN
Bethan Winter	WWU
Daniel Mee	Catapult
Richard Dobson	Catapult

2.4 Existing data exchange arrangements

Mature industry arrangements for communicating data exist within individual sectors in a number of places e.g. Grid Codes and Uniform Network Codes. Product 2 will consider the sharing of data more widely between parties and specifically between different vectors, where this would facilitate a more efficient whole system operation.

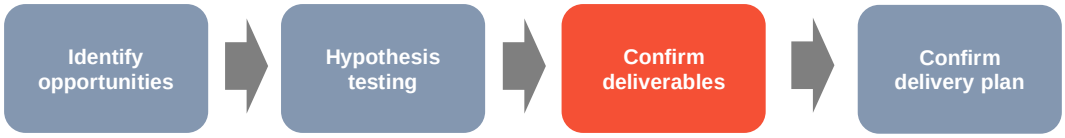
In addition, recent work has been undertaken as follows:

- Open Networks – Workstream 1B Product 3 covers real time data exchange between electricity transmission and electricity distribution.
- The Energy Data Taskforce has recommended key principles that energy system data should be presumed open and has identified three key building blocks as detailed below:
    1. A data catalogue providing visibility of Energy System Datasets.
    2. A registration strategy providing a coordinated approach to the registration of new assets.
    3. A digital, energy system map.

Networks have been asked to provide data strategies as part of their RIIO2 submissions and a Data Working Group is being established at ENA to coordinate work in this area.

2.5 Process

The process the Product Team has followed is summarised in the diagram below. This approach was agreed in June 2019.



The initial opportunities were explored and developed predominantly by the product team with their knowledge of existing processes and likely market developments.

We also discussed proposals to share information at the advisory group on 5th September. The slides, attendees and feedback from the advisory group are available on the ENA

website at the following location: http://www.energynetworks.org/electricity/futures/open-networks-project/open-networks-project-stakeholder-engagement/advisory-group.html

A distributed gas generation conference led by the gas distribution networks was planned for October 2019, but has been postponed to early 2020. A questionnaire is being sent to participants of this workshop and further information will be gathered during the conference with the aim of fully understanding the range of drivers that impact generating activities.

2.6 Identify opportunities

The key hypothesis at the inception of this product was that an improved understanding of the operation of the two systems by the other fuel counterpart would improve system operation efficiency, with cost reductions (vs the counterfactual) increasing consumer benefit. Specifically, understanding the operation of key loads connected to the power and gas networks such as gas generation and, in the future, power to gas would present the following opportunities:

- More efficient planning and operation of the gas networks in all conditions.
- The ability of flexible gas generation to support electricity networks' security of supply standards particularly at times of stress.

2.7 Hypothesis testing and evidence gathering

The product team took the initial hypothesis and developed a more detailed understanding of where the opportunity lies to deliver consumer benefit, using the perspective of different categories of licensee across the whole system.

National Grid (NG) Gas Transmission:
From an NG perspective the provision of generation data can improve demand forecasting accuracy potentially reducing the impact on market prices and associated price fluctuation. Improving the accuracy of Gas Distribution Networks' Offtake Profile Notices means National Grid Gas Transmission can plan the NTS (including compressor usage) more efficiently, potentially leading to lower own use gas and carbon emissions.

Gas Distribution:
Improved forecasting accuracy of generation will improve the quality of the Offtake Profile Notices provided to the National Transmission System (gas), which will benefit their operations as well as ensuring that gas distribution operating strategies are optimized.

Gas distribution requirements for good forecasting information will continue to grow as we anticipate increased use of smarter control systems in the future, particularly in networks where we need to balance the requirements of biomethane sites and flexible generations' requirement to take gas from the system at short notice.

Electricity Transmission System Operator (ESO):
The ESO would benefit from increased visibility of DNO connected load, generation, and constraint information (e.g. constraining solar export – covered by ICC).

Electricity Distribution Network Operators (DNOs):
Electricity Distribution Network Operators would benefit from increased information about gas constraints or commercial terms that may impact their ability to operate.

Customers and stakeholders:
Improving the operation of gas and electricity networks to support flexible generation will benefit customer and stakeholders as follows:

Flexible generation customers:

- Better support from networks to enable them to participate in generation markets as required.
- More streamlined communication routes reducing duplication.

All customers and stakeholders:

- Cost savings associated with more efficient network and compressor usage.
- CO_2 savings associated with reduced compressor usage.
- Support for intermittent renewable generation provided by flexible generation contributing to decarbonisation.
- Future benefits as principles are applied in the future to power to gas and hybrid heating system optimization.
- Optimal whole system operation will result in less disruption and increased reliability particularly at times of system stress.

Opportunities:

- More efficient system operation will reduce costs and improve resilience.
- Streamlined communication means consumers only have to provide information once.
- Improved forecasting accuracy.
- General transparency improves market efficiency – where data is shared publicly.

Risks:

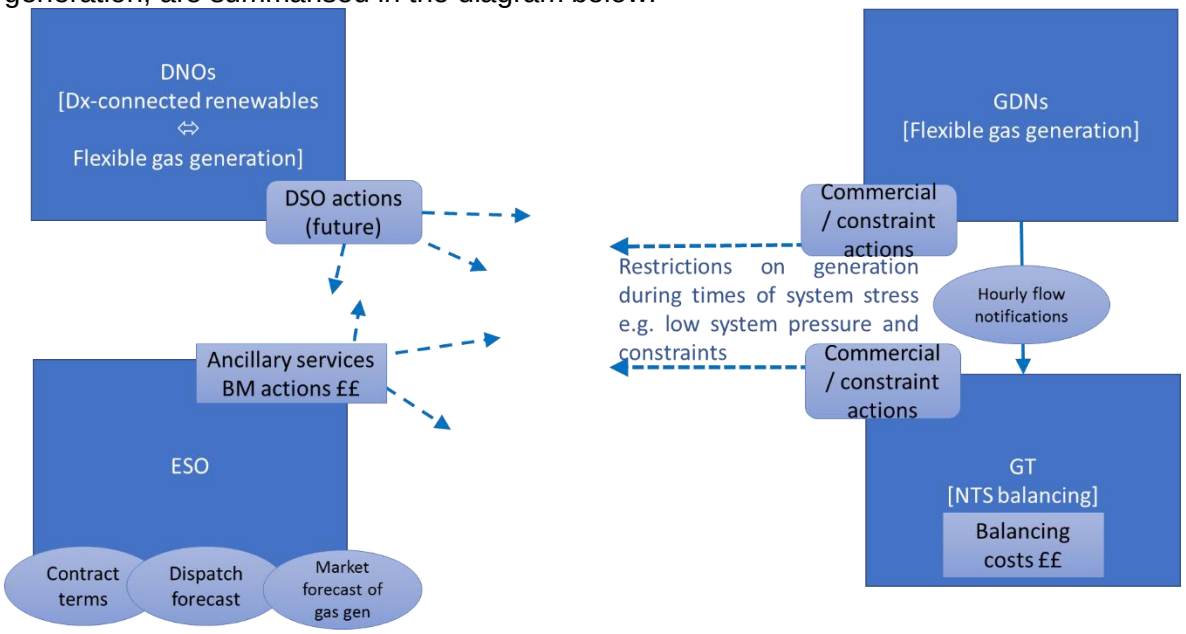
- Data is misinterpreted or misused intentionally or unintentionally.
- Market distortion – where data is shared publicly.
- Generation behaviour changes.

Approach
The potential for data sharing is significant and as detailed previously several groups are also looking at opportunities in this area.
In recognition of the scope of this product; including its focus on the next 3-5 years and prioritisation of quick wins, an approach was developed as shown in the following diagram. The adoption of this approach, which begins with identifying relevant data, was designed to ensure efforts were focused on sharing the data, which would add the most value.

Following feedback from the Open Networks advisory group the data template has been made available to third parties and is included in the appendix.

2.8 Control room activity interaction

As interactions and information flows between control rooms are a key element of the opportunities in this product, a workshop was held to understand the critical whole system issues. Key interactions between control centre activities, which impact the operation of gas generation, are summarised in the diagram below.



2.9 Key findings

The most significant benefits of this product were identified by the gas networks, which anticipate immediate benefits to network operating efficiencies when forecasting generation profiles are better understood.

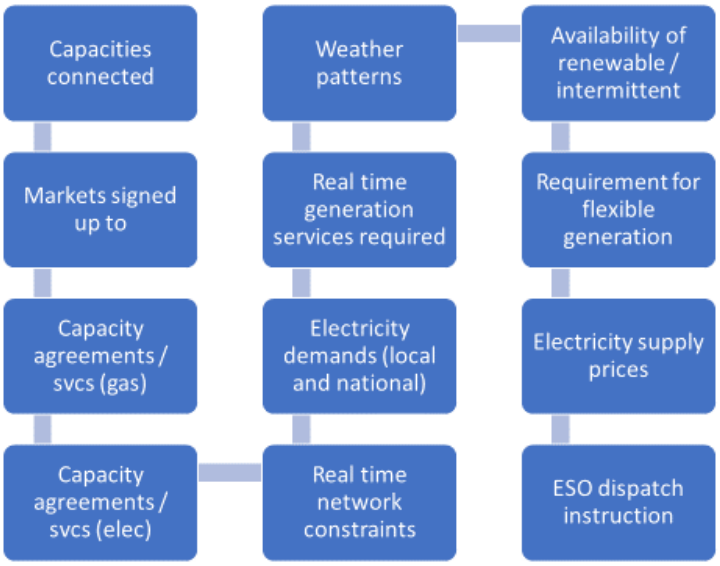
Due to the complexity around current markets and drivers, further work is required to identify all relevant data and processes, which could impact generation profiles. One example is the current and future role of aggregators.

Some forecast information is already published by the ESO and its innovation partners (such as Sheffield Solar) and gas networks can consider this in their operating strategies with immediate effect.

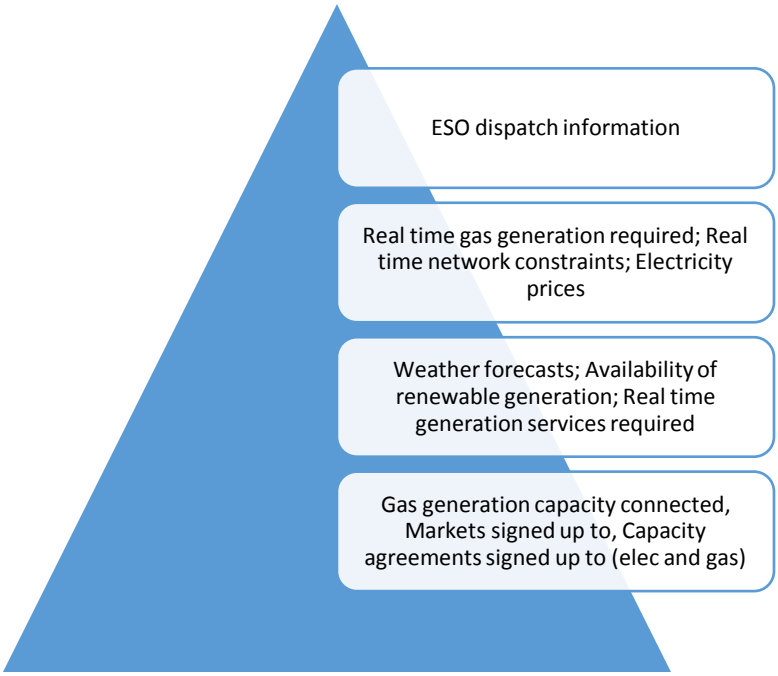
Sharing of dispatch information between control centres, initially from ESO to Gas Distribution and Gas Transmission is likely to have the biggest impact on process improvement in the short term and stakeholder feedback at the Advisory Group suggested that this would be supported, on the basis that control centres are not market participants.

Should it not be possible to share dispatch information, the sharing of other information which feeds into this process should be considered. This data is detailed in the array below. Following the generation conference referred to above and feedback from generators may result in additional items being added.

There was feedback that other stakeholders could benefit from further information being made more widely available and further work should be carried out to understand this.



The diagram below provides a schematic view of our current thinking on how data sharing should be prioritised. The nearer the top of the diagram, the higher the value in sharing, however this correlates with increasing barriers to access. Prioritisation has been determined based on whether the data provides primary information on dispatch plans (higher) or could be used in combination with other data to produce dispatching forecasts (lower).



2.10 Recommended next steps

A significant increase in gas and electricity network integration in operational timeframes will provide significant value as new low carbon technologies are implemented.

It is recommended that the value from data access and consistency in forecasting identified by Product 2be taken forward through a cross sector innovation project to develop gas generation forecasting models in one region, to test the operational improvements that can be made from existing processes. This project would be progressed outside of the Open Networks programme but progress updates would be shared with workstream 4 to share learning and avoid duplication.

The benefit of an innovation project in this area is that it will allow data sharing to take place under specific project agreements reducing time delays associated with formal regulatory change to enable this in some cases. Funding would be via the Network Innovation Allowance.

The proposed timeline and scope of the work is as follows:

Ref	Product Element	Duration	Timeline	Activities & Deliverables
1	Confirm scope, participants and partners for innovation project – ideally all 4 sectors in coincident geographies	2 months	Jan- Feb	Innovation project initiation
2	Communications event with ON and advisory group		March	Engagement: Present the scope of the innovation project and timeline (if required)

3	Develop prototype model for forecasting flexible generation	6 months	March - August	Innovation project delivery: 1: Report detailing relevant operational data already shared publicly: by ESO, GDN, NTS and DNO (case study in WWU region) 2: Report detailing other data that is available for sharing e.g. locations of flexible generation, market information 3: Development of flexible generation modelling capability using the data above (shared via NDA as part of the project) 4: Assess the initial performance and impact of the forecasts (for each sector). 5: Output: a report detailing activities undertaken and the outcome of the assessment in 4.
4	Communications event with ON and advisory group		September - 2020	Engagement: Present the report from the innovation project. Discuss findings and opportunities
5	Communications with Networks		September – October 2020	Industry engagement: Present the report from the innovation project. Discuss findings and opportunities. Agree next steps / options for implementation in individual networks or as a centralised service.

3 Product 4: Investment Planning

3.1 Introduction

Investment Planning: Product 4 was approved to proceed by the Open Networks Steering Group on the 18 April 2019. The aim of the product is to identify and realise consumer benefits by applying a whole system approach within the investment planning processes.

Anticipated outcomes:

- Higher quality robust data;
- Lower stakeholder and network costs;
- Higher value solutions for customers and stakeholders;
- Optimised network utilization;
- Delivering timely capacity;
- Improved more efficient relationships;
- More efficient decision making.

3.2 Scope

This product covers the medium and longer term investment planning processes, delivering network capacity decisions for our customers and stakeholders in the three year ahead timescale.

Existing network or sector specific processes exist, and this product's scope explores the potential value from greater coordination, collaboration, refinements and evolution, to deliver tangible benefits valued by our customers and stakeholders.

3.3 Team members

Product 4 was supported by a range of network and other stakeholder participants:

Name	Company
Matt White	UKPN
Mark Herring	NG (SO)
Gordon Graham	ESC
Oli Spink	WPD
Nick Harvey	NG (ESO)
Linda Forbes	WMCA
Mark Hamling/Paul Sullivan	NG GSO

Name	Company
Maciej Fila / Steven Gough	SSE
Flo Silver	OFGEM
Charles Wood	Energy UK
Colin Thomson	SGN
Ian Dunstan	WWU
Anna Livesey	Coventry and Warwickshire LEP

3.4 Existing data exchange arrangements

Mature industry arrangements for the communication of investment planning related data exist within individual sectors, including gas and electricity industry codes, ten year and long term development statements. These are produced, maintained and updated by established governance processes and supporting licence obligations. More fundamental change to these is driven by wider framework and code reviews as well as other industry initiatives including Open Networks and the Energy Data Taskforce.

Of particular relevance to this product is the development of the electricity Network Options Assessment framework, and the recently published conclusions from the Energy Data

Taskforce. The latter recommends the development of an open data environment for energy system data.

3.5 Process

The process the Product Team have followed is summarised in the diagram below. This approach was agreed in June 2019.

3.6 Identify opportunities

Opportunities were identified at the initial workstream workshops and subsequent meetings, involving both network representatives and wider stakeholders. This produced an initial long list of opportunities.

3.7 Prioritise

The Product Team then considered the ease and speed of implementation and the potential benefits in order to prioritise the opportunities. Three deliverables in two opportunity areas were identified: Information Flow and Delivering Solutions. These were based on the hypotheses below, agreed by the work stream:

Opportunity Area	Hypotheses
Information Flow	A single entity undertaking the information gathering activity from local bodies will reduce costs for all parties, remove the potential for inconsistencies, create a consistent trusted data set, and provide a basis for networks to feedback related issues on their networks.
	There is data that a network could provide that would help customers and stakeholders from another network e.g. gas network capacity info for gas power generation.
Delivering Solutions	Applying a whole energy system approach can generate a better and more valuable range of options to meet customers and stakeholders longer term development needs.

At the lowest level, these benefits deliver direct and indirect cost savings. An example of indirect cost savings is the identification of options that can be delivered more quickly, potentially with a higher direct cost. The faster delivery results in earlier development, economic growth, decarbonisation and clean air improvements.

3.8 Hypothesis testing and evidence gathering

The evidence gathering to prove or disprove the hypotheses was taken from contributions from across the Product Team in June and July, by addressing the questions below. This was supported by a series of bilateral conversations between the Product Team members and the Product Team lead.

- How do networks currently gather and use regional information, if at all?

- Have the networks any examples where regional data inconsistencies have caused issues?
- What information from the networks would stakeholders value (and quantify value where possible)?

For a number of years, WPD have been using an external agency: Regen, to pull together their regional demand and generation data. In the last year, Wales and West Utilities have also started working with Regen on their regional energy plans. More recently Cadent have started working with Regen, and have also sought to re-use existing data from WPD where this is common e.g. gas powered generation and CHP, and housing and business growth plans and forecasts.

National Grid have started to use more granular regional data in the development of their forecasts and scenarios through the improvements delivered through Workstream 1B of the Open Networks Project.

From the feedback received, data inconsistencies have been experienced and caused issues for the networks. From the non-network team members, the identification of specific data items and the value that could be realised was not straightforward. The information on regional data acquisition is shown in the table below.

Network	Summary of regional data process	Use of external agency (Y/N)	Indicative annual cost	Date Consistency issues
Cadent	Sourced from regional bodies by Regen supplemented by data already obtained for WPD. Data used to develop forecasts and scenarios for Business Planning.	Y		Potential conflict between bottom up and top down forecasts. Some consistency by using same source data from WPD.
WPD	WPD provide a pipeline of accepted-not-yet-connected generation and storage customers, which Regen cross reference with a variety of sources (including FIT, RO and REGO installation data) and spatially allocate to an Electricity Supply Area. Further out, the FES scenario framework is used with reference to local authority planning data to spatially allocate future growth per technology type. For new domestic and non-domestic demand developments, an analysis of local authority development plans is undertaken in consultation with local authorities – this is then spatially allocated to an Electricity Supply Area.	Y		DFES scenarios follow the same framework as National Grid FES scenarios; however DFES studies are updated on a two yearly basis. There is potential inconsistency when FES scenarios change, and this is not updated straight away in DFES studies. Potential conflict between bottom up and top down forecasts due to different methodologies of spatially allocating technology growth.
Wales and West	Regional FES project supported by regional workshops in Exeter, Bristol, Cardiff and Llandudno with our stakeholders to review the methodology and assumptions to the work, including a 5th scenario Hybrid Accelerator Additional project and research with Monmouthshire council, Bridgend Council, Cornwall, Bridgend, Green City, Swindon.	Y for the regional FES		Several data sets exist, and can be different results from top down and bottom up forecasts. Can be differences between data types, visions, targets, scenarios and central cases especially when looking at the longer term.
ENW	Uses bottom-up modelling to assess regional trends for Low Carbon	Y		Inconsistencies between regional and central

	Technologies (LCTs), renewables, other distributed generation and baseline demand. Within the rationale of our DFES (not following FES) we use Element Energy expertise in consumer choice modelling to assess future regional uptakes for both LCTs and renewables. We also use internal resources to consider the effects of proposed, accepted and recently connected demand connections through the analysis of historical data and current activity. Planning data and information from our local stakeholders (e.g. zero carbon / air quality plans of local government) is also gathered and processed (e.g. affecting regional EV and PV uptake trends). Information from our network planning (e.g. planned reconfigurations and reinforcement) is also processed internally to assess effects on future demand and generation.			government information on planning data (e.g. land for commercial developments).
SGN	Sourced from: • Local Authority Local Development Plans • Local Authority Housing Land Audits • Local Authority development GIS files (directly from the LA's and via 3rd parties working on their behalf – e.g. Improvement Service for Scotland) • Face to Face Meetings with LA's and developers • Workshops with LA's and developers • Meetings/data sharing with LHEES and LEPs Data used to develop forecasts and scenarios for Business Planning.	N	Internal costs associated with Man Hours, but no external agencies are employed to facilitate this type of data gathering.	Inconsistencies between the data supplied from the different levels of regional government Inconsistencies between regional and central government decarbonisation strategies

A workshop was also held on 31 July with the Gas and Electricity Networks and Coventry and Warwickshire Local Enterprise Partnership to understand their needs, identify potential solutions, and identify value from the provision of additional options. Notes from this workshop are included in the appendix.

Whilst there was still further work to confirm the outputs with Coventry and Warwickshire stakeholders, the workshop's initial conclusion was that there would be significant value for the stakeholders from the development of whole system solutions. The benefits discussed included:

- Enabling a wider range of options to be considered in parallel.
- The identification of efficient infrastructure needs to supply a range of phased developments.
    - Single solution for multiple phases is likely to be much more efficient than individual piecemeal solutions for each phase.
    - The early identification of infrastructure allows mechanisms to be identified and agreed to enable the timely installation e.g. consortium agreements or the provision of financial security.
- Availability of whole system solutions can allow energy infrastructure factors to be incorporated in local plan development and options assessment, with the potential to select sites with lower infrastructure requirements. It can also facilitate planning

decisions to support the infrastructure including the identification and provision of corridors, easements and land for electricity and gas equipment.
- Efficient processes and clearer relationships with networks would improve energy system knowledge and long term decision making within regional authorities, including the development of clean air and decarbonisation strategies and other responses to environmental emergencies.

The workshop also identified the value in the provision of network information, both in terms of the extent of the networks, and where there was available capacity.

3.9 Opportunities identified

By proving the hypotheses, the benefits derived from the opportunities and deliverables are confirmed. The draft deliverables proposed by the Workstream at this stage are:

1. On behalf of the networks, a single procurement strategy and process will procure, update, and share the critical data from regional bodies required for planning medium and long term incremental network capacity.
2. Accessed from a central hub, and consistent with the Energy Data Task Force principles, the networks produce “heat maps” showing their networks and areas of spare/scarce entry and exit capacity overlaid on regional plans.
3. A whole system optioneering service, providing Local Authorities with options to meet their future requirements, including decarbonisation and responses to Climate Emergencies, to enable the establishment of regional energy infrastructure plans. The service would be triggered by application from the Local Authority/Regional body.

3.10 Recommended next steps

1. Pursue a coordinated approach to gathering regional data

   As many network companies currently have contracts with existing data providers, the delivery plan below is not set to a specific date and rather shows the steps required to pursue this recommendation once collaborating network parties have aligned timescales.

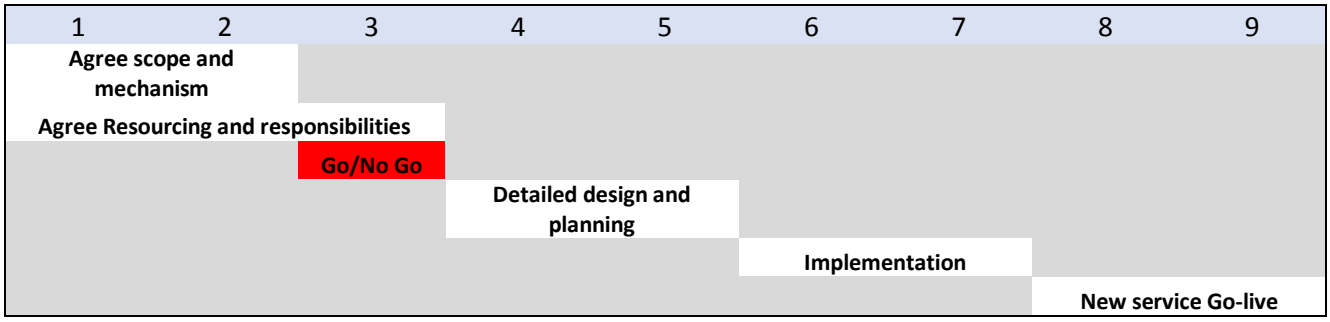
   - Agree scope for service including generic basic data, and data provision/sharing mechanism.
   - Agree mechanism to coordinate gathering of regional data e.g. procurement of service provider, or agreed common data framework.
   - Go / No Go Decision from networks to implement including resourcing and responsibilities for detailed design and implementation plan, including cost allocation.

   Subject to Go/No Go decision:

   - Complete detailed design and implementation plan for delivery mechanism
   - Implement delivery plan.
   - New coordinated service commences.

Should implementation involve a procurement event, to minimise complexity, it is assumed that the service would be procured by the ENA on behalf of the networks, but the contract will need to have scope to allow individual companies to request supplementary information.

The anticipated timetable for delivery of this opportunity is summarised below and will be further informed as the product develops and the delivery mechanism agreed:



If a procurement event is required there will be a central resource requirement for a Procurement specialist to deliver the:

- Procurement strategy: 40 days
- Procurement event: 25 days
- Contracting: 10 days

2. Network Capacity Heat Maps

It is recommended that a central hub be established to publish existing network capacity information, with a parallel process to confirm basic data requirements that must be filled going forwards. The hub may therefore proceed initially without data from all networks.

This recommendation is expected to be delivered through the ENA Data Working Group project on building a digital network map, with constraint information being one of the high value data layers available through this tool.

- **Existing data:** Identify and document existing published network resources or other resources that already exist and could be published.
- **Identify and fill gaps:** Provide an initial view of priority data gaps

Handover to ENA Data Working Group

Potential activities for the WG could include:

- **Basic data specification:** Based on existing information and knowledge from each network, agree the basic data specification for entry and exit capacity.

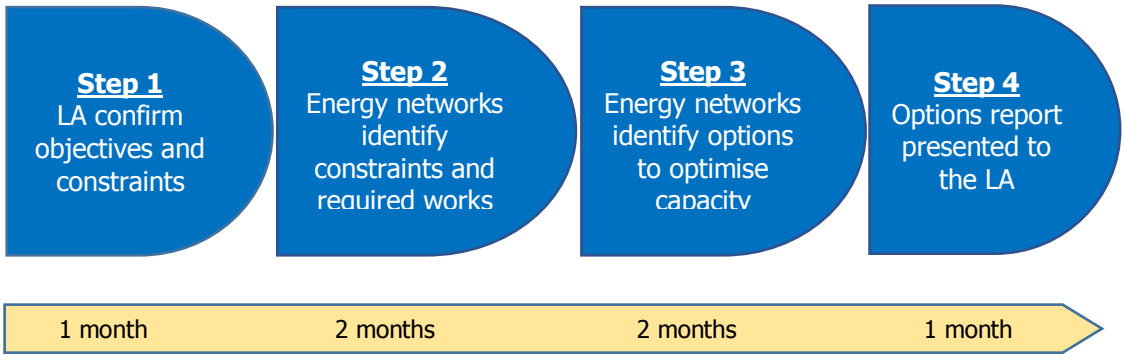
- **Design Central Hub:** Identify the most cost-effective approach to making the existing information available via a central hub, taking account of energy data taskforce recommendation and developments, as well as stakeholder engagement. The approach should also be capable of accommodating new basic data from other networks that may become available in the future.
- **Approve Central Hub approach:** Paper presented to the networks with a recommendation on the preferred way forward to publish and maintain the data.
- **Delivery:** Implement the recommendations

It is anticipated that the initial review of existing data and identification of initial priority gaps, prior to handover to the ENA Data Working Group would take 4 months to complete.

3. Whole system optioneering service

   It is recommended that this opportunity be pursued through work stream 4 in 2020. There is potential to support and leverage nascent work by the Energy Systems Catapult on Local Area Energy Plans to improve the reach and resource of this product.

   - **Identify trial areas:** Networks consult stakeholders to agree trial regions
   - **Complete a minimum of three trials** across the UK with the aim of providing experience and information from all parties involved to enable the design of a universal service across the UK.
   - Each trial to end with the networks presenting an options report for the LA, including desktop illustrative costs. How the networks and LA proceed with the findings is outside the scope of this Product deliverable.
   - Working with a Local Authority or other regional body, the trail to follow the high level process below lasting a maximum of 6 months:

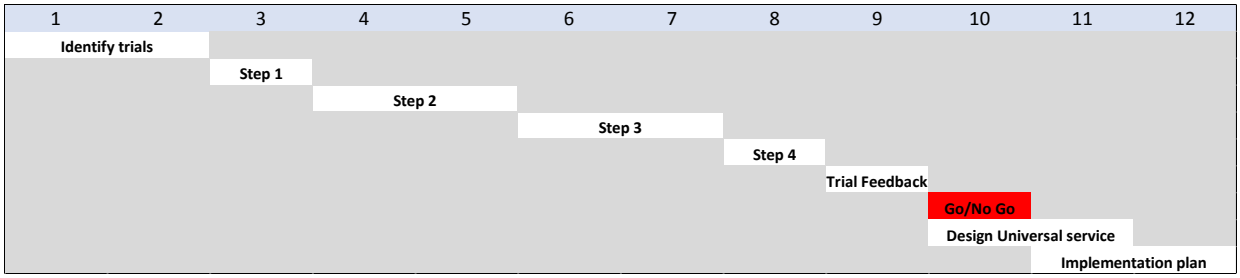


Step 1	Step 2	Step 3	Step 4
LA confirms the objective to be met, which could include clean air,	The energy networks independently identify the efficient	Where network reinforcements are required or where significant delivery	The networks present the options to the LA and responds to any

decarbonisation, housing, business and industrial growth, renewable energy projects or waste to energy production. Constraints could include timescales to provide energy network capacity or to reduce emissions, and land or other physical constraints. The LA may include options/scenarios such as different low/zero carbon transport or heating solutions.	sector specific investments required to their networks to provide the incremental capacity, including indicative timescales and delivery risks.	risks are identified, the networks will work together to produce alternative options using available capacity on the other network. The networks can also consider conversion of existing customers to the other vector as a tool to derive a full range of options. Examples could be conversion of electric heating on to a district heating scheme, or switching a multiple occupancy building from individual gas supplies to electric heating (or a local CHP).	supplementary questions
	Some aspects of Steps 2 and 3 could be combined		

- Engagement with the LA to be maintained through the design phase.
- **Trial Feedback Report:** At the end of each trial the host networks will prepare a feedback report, supported by the LA, describing the process they have followed, the value delivered, and what has worked well, and less well.
- **Design universal whole system optioneering service:** When all trials are completed, and if the workstream agrees that there is value in proceeding, a one-day workshop will be held for the whole workstream to design a universal service. Workshop to also agree whether this should be a chargeable service, or free of charge.
- **Implementation Plan:** Develop and agree an implementation plan, including addressing any regulatory framework changes e.g. Code/Licence/Price control
- **Deliver Implementation Plan**
- **Monitor progress annually and agree updates to process as required**

The anticipated timetable for delivery of this opportunity is summarised below:



Central Resource requirements:

- Collate trial feedback and design universal service: 40 days
- Implementation plan: 30 days

4 Appendix

4.1 Consumer benefit

The framework used by WS4 to discuss consumer benefit defines 5 categories of benefit:

1. **Improved safety and reliability**
   As the energy landscape continues to decarbonise and transform, the energy system has much more complex flows of energy, and there is much to do to maintain our system's high level of safety and reliability for consumers.

2. **Lower bills than would otherwise be the case**
   Efficiently managing the whole energy system through system operation, markets, and network decisions lead to lower costs flowing through to the bills of end consumers.

3. **Reduced environmental damage**
   Improving decisions made by the energy industry can enable a lower carbon energy system and reduce the broader environmental impact of our energy system.

4. **Improved quality of service**
   Improved quality of service for the connected customers and stakeholders of energy networks ultimately benefits consumers as interactions in the value chains across industry become more seamless, efficient and effective.

5. **Benefits for society as a whole**
   Providing transparent, accurate information can facilitate industry discussion, foster innovation and improve decision-making which ultimately benefits consumers and society as a whole.

4.2 Potential WS4 products: brainstorming session output

	Operations (Real time)	Planning (weeks & months ahead)	Investment (years ahead)	Emergency & Incident Response	Connections
Customer Experience (the service provided to network-connected parties, and end consumers)	- Facilitating decentralised gas generation	- Connections timescales; need to meet customer requirements - Efficiency measures - Co-ordinated planning across utilities - Understanding current vs. future customers	- Increased ambition on carbon targets; net zero	- Black start - Co-ordinated incident response - Rotor load disconnection	
Governance (making changes in policy, regulation, and codes are made)	-	- Joint stakeholder engagement and dissemination	- Innovation funding/pilot projects -		
Network operability (technical issues of how energy networks operate)	- Dealing with the peaks across gas and electricity - Removing electricity network constraints using other solutions such as heat networks or CHP	- Planned outages - Optimisation of losses	- Behind the meter demand/generation optimisation; how does this affect the networks? - Sharing telecoms		

Markets (using competitive markets to provide solutions that maximise consumer benefit)			- Whole system investment CBA (e.g.: whole system NOA, especially across vectors) - Decarbonisation of heat; agreed a way forward		
Charging (who pays for the delivery of energy, and this process)	It was agreed that we should wait for the outcome of the SCR – charging is a medium/long term initiative.				
Data (how data and information is used across the industry)		- Whole system model	- Aligning/creating agreed whole energy system future scenarios - Information sharing between DNOs and GDNS on visibility of costs		
Other					- Network innovation funding (NIA, NIC) is allocated to specific network licensees, which are single vector entities.

4.3 Initial high level scopes for work products

High-level scopes for the products were presented to the Advisory Group in May: http://www.energynetworks.org/assets/files/ON-PRJ-AG%20Combined%20Slides%20(2%20May)%20v9.pdf

4.4 Product 2 template for data sharing with network companies and stakeholders

Name		
Company		
Date		
Problem to solve		
Process supported		
Description		
Data type		
Fuel type		
	Best case - what you would ideally like	Worst case - what would still be useful
Granularity (time)		
Granularity (location)		
Measurement		
Act/forec/estimate		
Benefits / reason		
Frequency of update		
History		
Site type		
Units		
Geographical info		
Comments:		

4.5 Workshop output for Product 4 with Coventry City Council

Open Networks Workstream 4 – Investment Planning Product Group
31 July 2019 | 10:00 – 14:00
Location: WPD Pegasus Office

Attendees	Company
Oli Spink	WPD
Ben Godfrey	WPD
Stuart Easterbrook	Cadent
Phil Halsey	Cadent
Anna Livesey	Coventry City Council
Lowell Lewis	Coventry City Council

Item Number	Description	Lead
1	Introductions	OS
2	**Characteristics of current energy networks (near term - 3 years out)** - Summary of investment planning and information available from WPD and Cadent - Including network capacity map and energy data hub on WPD website. - Noted that the date of publication of various investment planning strategies (DFES, Local Plan etc.) do not align so may be based on outdated input data. *Action* *1. WPD to share links to energy data hub*	WPD and Cadent
3	**Coventry & Warwickshire Energy Infrastructure requirements (3 years +):** - Summary of current process for investment planning and how energy infrastructure is considered. - Would be useful to have a repository of information from utility companies to be able to identify where there are capacity constraints for future developments. - Noted that for phased developments, the connection design which considers the entire development may be cheaper/more holistic rather than a number of phased 'piece-meal' connections.	Coventry City Council
4	**Brainstorm possible whole system solutions and capture C&W/WM initial thoughts.** - For developments in the most recent Local Development Plan by CWLEP, potential to assess connection design to both electricity and gas networks. CWLEP would provide information on prospective demand/generation requirements. - Where there is a constraint in connecting to either of the electricity or gas networks, consider a range of solutions (conventional, innovative and cross-vector).	All

	- Noted there is no 'one size fits all' approach to every development, so a variety of sites to be identified to enable a range of solutions to be suggested by WPD and Cadent. - For multiple adjacent developments/connections which require upstream reinforcement, potential to look into the feasibility of a consortium approach as a way to spread risk across parties. *Action* 2. *WPD to share links to consortium agreement webpage.*	
5	**What whole system service would C&W/WMCA value:** - General interest in a set of case studies based on developments in the most recent Local Development Plan. - Would require the support of WMCA. *Action* 3. *Coventry City Council to gain consensus for the scale of work.* 4. *If the work has the support of interested parties, 5 areas to be identified for review with prospective demand/generation requirements* 5. *Connection design for 5 areas to be reviewed by WPD and Cadent for potential constraints.*	All
6	**Discussion on how to apply learning to other GDNs/DNOs/local authorities across GB** - Potential to create a template for Local Authorities & LEPs to follow when assessing infrastructure. *Action* 6. *Dependent on previous actions, WPD/Cadent to scope a process for Local Authorities to follow when drafting investment plans, with contacts/routes of entry for each network operator.*	All
7	AOB and feedback to Product 4 group/Workstream group	All

Summary of actions

1. WPD to share links to energy data hub
2. WPD to share links to consortium agreement webpage.
3. Coventry City Council to gain consensus for the scale of work.
4. If the work has the support of interested parties, 5 areas to be identified for review with prospective demand/generation requirements
5. Connection design for 5 areas to be reviewed by WPD and Cadent for potential constraints.
6. Dependent on previous actions, WPD/Cadent to scope a process for Local Authorities to follow when drafting investment plans, with contacts/routes of entry for each network operator.