Energy Planning Integrated with Councils (EPIC)

Closedown Report

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1. Executive Summary

EPIC (Energy Planning Integrated with Councils) was a joint NIA project funded by Western Power Distribution (WPD) and Wales and West Utilities (WWU). WPD later became part of National Grid. The project ran from February 2021 to December 2022 and had an overall budget of £540k. EPIC explored how network companies and local authorities can work effectively together to create local energy plans and support the production of investment plans with an understanding of the costs and benefits from a whole system perspective. Energy modelling focussed on the impact of the key building blocks within the Distribution Future Energy Scenarios (DFES). DFES building blocks are different items that can impact demand e.g. items such as domestic PV, heat pumps (HPs) and Electric Vehicle (EV) chargers as well as new houses, new commercial customers etc. The number of units for these building blocks were set at a level to reflect the local authorities plans and ambitions in a local energy plan before using network modelling to determine where and when network issues were expected and to consider the options to resolve these. As the impact of DFES are already routinely considered on networks that are 33kV and above, EPIC focussed on the impacts on the High Voltage (HV) and Low Voltage (LV) networks for electricity and the equivalent areas for the gas network. The project aimed to develop a replicable process that could be applied with the many local authorities that are present in licence areas operated by National Grid / WWU.

Three trial areas were selected within the area covered by West of England Combined Authority (WECA). The LV networks were modelled using the Network Investment Forecasting Tool (NIFT) from EA Technology whereas a new HV Network Assessment Tool (HV NAT) was developed by PSC to model the HV networks. The requirements of future gas modelling for hydrogen networks were considered but full complex gas modelling was not required as it became evident that all scenarios had an overall reduction in gas consumption and therefore no gas network reinforcement was required. Modelling results were then combined in the Whole System Cost Benefit Analysis tool originally produced as part of the Open Networks project. The analysis covered a number of use cases comparing options and sensitivities relating to EV public chargers, hybrid heat pumps, investment strategies, flexibility services, energy efficiency, heat networks and additional ground mounted solar deployment.

The results of the analysis generally showed that the benefits of one option over another within each use case were relatively small with the exception of the investment strategies where the “Fit for the Future” option resulted in significant savings by avoiding repeated upgrades at the same sites. However, the current regulatory framework is not set up to capture very long term trade-offs that occur between price control periods that could be thirty or forty years apart. The use of rapid EV charging hubs had similar overall costs to deploying only LV connected on-street public chargers as the savings on LV reinforcement were negated by higher HV costs. Energy efficiency and hybrid heat pumps were seen to reduce overall reinforcement requirements as expected but the costs of achieving those reductions are largely unknown. It is expected that the DEFENDER project will shed some light on the most cost effective interventions for different types of property. Flexibility services on LV or HV networks are not currently cost effective but could potentially become so in the future with a wider market increasing supply and therefore reducing flexibility costs. However, the availability of a suitable volume of services in the required location may still be an issue.

The project has uncovered a number of data quality issues which took considerable resources to resolve on a relatively small test area. Similarly there would need to be additional automation applied to the steps in the EPIC process to reduce the resource requirement to a point at which it could be practical to implement. However, the process could be used to provide insights on additional use cases to support local authority policy decisions. Similarly the process to create long term load forecasts at HV and LV could be used to inform LV and HV asset replacement decisions by showing the likelihood of future capacity related issues.

2. Project Background

As part of the process to create Distribution Future Energy Scenarios gas and electricity utilities reflect local and regional factors as well as information from local authority development and decarbonisation plans. Local authorities are consulted and give input to the DFES process however the DFES, since it is based on national scenarios, does not wholly adopt or incorporate local authorities' longer term strategic plans. This could lead to different expectations of future energy requirements between the local authority and the utilities. There is also a potential missed opportunity to align plans across energy networks and to take a more holistic and strategic view of future investment options, which could lead to better investment outcomes both for the networks and for regional stakeholders. To close this gap a new process needs to be developed which will align planning assumptions but also provide stakeholder input into the way solutions to network constraints are selected. These solutions may involve non-network options such as flexibility services. Given the large number of different local authorities that the network operators liaise with, the new process needs to standardised but still be able to work with differing levels of available data.

The project developed a process to support the creation of an integrated local energy plan in a format that can be incorporated back into a DFES analysis. This process overlaps to a certain degree with that being developed for Local Area Energy Planning (LAEP) but EPIC is not intended to provide a complete solution to LAEP and also includes elements that are not within the LAEP remit. Local energy plans were produced and used to modify the National Grid Best View and WWU regional gas scenarios, which were then used to determine the changes in profiles for electricity and gas usage. Power flow and gas flow analysis determined the expected network issues resulting from those load and generation profiles and investments to overcome them were proposed. For National Grid it was recognised that the network modelling workload was too much to be supported by a planner and therefore the project defined and developed a new tool to automate analysis of the HV network and the existing Network Investment Forecast Tool (NIFT) was upgraded and used to assess the impact on LV networks. For WWU the project identified and developed potential enhancements to the process of incorporating local authority information in their investment plan. Similarly WWU enhanced the data that they use for analysis to reflect developments in the use of hydrogen and bio-methane.

A set of use cases to test were jointly developed with the local authorities which allowed for different approaches to be compared to each other. Some additional sensitivity tests were added to the use cases to compile an agreed set of test runs. The planned investments on the electricity network were intended to be combined with those gas network and the local authority in a new tool to help determine the combined benefits different sets of potential investments. The project adopted the Whole System Cost Benefit Analysis (WS CBA) tool that had been created under the Open Networks project but had not yet been used in a real-world application. The WS CBA tool allowed for a variety of different costs and benefits to be modelled using a Net Present Value (NPV) approach to assess trade-offs. The tool was enhanced with processes to automate the import of standardised files from the network analysis tools and to produce standard charts. The learning from analysing the different use cases and their associated sensitivity tests was captured in a set of Use Case Learning Reports and disseminated to the local authorities to inform their policy decision making.

3. Scope and Objectives

EPIC's scope was around the long term planning processes for the two network operators, National Grid and WWU, and the local authority. The project built on the existing process to build a DFES and analyse its impact. This is currently used to create National Grid's shaping sub-transmission reports which consider the 132kV, 66kV and 33kV networks. Rather than replicate the existing process, EPIC was intended to create a complementary local energy plan and model its impact on LV and HV networks. The analysis of the networks and the generation of solutions and investment options was required to consider at least one primary substation in each of the three selected trial areas.

EPIC was expected to generate learning in terms of how to;

- Look holistically at the total energy requirements across a strategic area with multiple energy connections and customers
- Work across networks (gas and electricity) and across energy vectors
- Develop an energy development plan, rather than "scenarios", albeit with a number of investment options
- Build in the use of flexibility and non-network solutions as part of the analysis – rather than as a secondary consideration
- Jointly create a plan that is jointly owned and endorsed with local stakeholders and align the energy plan with the local authority's own infrastructure master plan and strategic development plan
- Meet the requirements of local area planning guidelines regarding methodology, assumptions and data transparency

The objectives for EPIC are given in the table below. An explanation for the assessed status is given in section 6 Performance Compared to Original Aims, Objectives and Success Criteria.

Table 3-1: Status of project objectives

Objective	Status
Develop a standardized process that can be used with different local authorities to create a local energy plan.	✓
To create energy plans for the three trial areas	✓
To determine how to reflect the local energy plans in the DFES used for network planning purposes	✓
To disaggregate the DFES data to support LV and HV planning	✓
To develop a tool to support automated analysis of HV networks and suggest network remedies	✓
To analyse the HV and LV networks associated with at least one primary substation in the trial areas and provide a view of the network and non-network solutions under different investment strategies	✓
To develop a tool to allow the investment plans for electricity networks, gas networks and the local authorities to be compared to identify potential synergies	✓
To use the tool to create an Integrated Investment Plan in the trial areas.	✓
To refine the processes to reflect the learning gained during the project.	✓

4. Success Criteria

The success criteria for project EPIC are given in the table below. An explanation for the assessed status is given in section 6 Performance Compared to Original Aims, Objectives and Success Criteria.

Table 4-1: Status of project success criteria

Success Criteria	Status
The process to create investment plans jointly between electricity and gas utilities and the local authority will have been developed.	✓
The process will include flexibility and other non-network solutions as options to alleviate network constraints.	✓
The process will have been applied to develop joint plans for at least three trial areas.	✓
The process will have been refined to reflect learning from the real-world use	✓
The process will have been assessed in relation to the LAEP method document and/or subsequent guidance from Ofgem regarding Local Authority Energy Planning	✓
A plan development support tool will have been developed to assist with the appraisal of investment options and to provide the evaluations necessary to improve plans e.g. by changing investment combinations, scale, timing etc.	✓
An HV network analysis automation tool will have been developed so that real network issues can be identified for the energy scenarios and variants.	✓
The support tools will have been refined to reflect learning from the real-world use.	✓
The impact of different investment strategies i)"just in time" at point of need investment, ii) "One touch" future proof investment (Fit for the Future) and iii) anticipatory or strategic investment will have been assessed.	✓
The benefits from the jointly created plans compared to the individually created plans will have been assessed.	✓
The learning from the project will have been collated into a report and disseminated.	✓

5. Details of the Work Carried Out

The project was delivered via a series of work packages as described below.

WP1 – Trial energy planning area selection

Working with WECA and local authorities the project selected three suitable strategic development areas to reflect the variations between local authorities within the WECA region, a mix of urban and rural geographies, a range of energy requirements including new developments, energy efficiency, energy generation, green gas, transport and opportunities for flexibility and energy storage. During this work package the project also defined the scope and boundaries of the strategic areas and identified key energy opportunities/challenges to be considered as a set of use cases and sensitivities to be modelled.

WP2 – Development of a local energy plan for each area. Including process design, trial design & support tool specification.

During this work package the project examined the existing planning processes for the local authority, electricity and gas networks. This involved bringing together DFES data and planning data and energy requirements from local authority and WECA decarbonisation action plans, net zero analysis and existing transport, new development, energy efficiency and heat strategies.

Using inputs from WECA and LA's Regen developed the process to create a Local Energy Plan in a format that can then be compared with, and incorporated into, network DFES forecasts. The process definition including the data exchanges, timings, roles, methods of engagement, data gathering, forecasting assumptions etc. The document "Local Area Energy Planning: The Method"[1] developed by CSE and the Energy System Catapult was used as reference material. Regen have been involved in the process of our DFES for many years and so brought a lot of experience to the project.

This process was then applied for the three trial areas, working with WECA and Local Authority teams, to create Local Energy Plans. Alongside the development of a Local Energy Plan this element of the project identified and defined the requirements for new and enhanced support tools required for both local energy data exchange, network planning and investment appraisal. The way in which the different investment strategies would be modelled was decided as was the range of sensitivity analysis required. These decisions were fed into the specifications for the various support tools including:

- New HV analysis tools – see WP4E
- Use of the existing NIFT toolset for the LV network
- Development of a Plan Development Support Tool – See WP3
- Enhancements to existing gas network analysis tools – see WP4G

WP3 – Plan development support tool – detailed design, development, testing & documentation.

During this work package it was originally intended to develop a tool to compare planned investments from the local authority, electricity and gas networks to create an Integrated Investment Plan. The tool was required to support selection between options using criteria that reflect the value more holistically by incorporating costs and benefits that go beyond those that relate directly to the networks, but include the benefits to the public, environment and local authority etc. It was intended that before developing a new tool from scratch the potential to use the Whole System Cost Benefit Analysis tool (WS CBA) developed as part of the Open Networks would be assessed first as this could save duplication of effort while providing the first real use of the WS CBA tool and therefore providing valuable feedback.

WP4E – Electricity HV analysis tool detailed design, development & delivery

This work package was necessary to automate the process for analysing HV networks. This included work to create baseline profiles from monitored SCADA data for use in the top-down modelling in order to populate the Sincal network model. Similarly the design covered interfaces with the NIFT which provided data for the bottom-up modelling approach and importing the disaggregated DFES data prepared by Regen. The HV Network Assessment tool was developed by PSC using python to automate the manipulation of the network model within Sincal and to automatically apply flexibility services or reinforcement when network issues were detected. The tool was designed to support all the use cases and therefore was required to model both Just-in-time and Fit-for-the-future investment strategies, different levels of energy efficiency, and differing availability of flexibility services as well as different scenarios that were modelled via different DFES values. The software followed the same process outlined in the Customer Behaviours Document[2] to determine the impact of the local energy plans on future load / generation profiles.

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[1] Local Area Energy Planning: The Method

[2] Customer Behaviours Document

In addition to the development of the HV NAT, the Network Investment Forecasting Tool, the NIFT, was upgraded to allow for the modelling of a range of configurable energy efficiency values and to produce the output files to be used by the CBA tool and the HV NAT.

WP4G – Gas network analysis tool development

This work package included the development of new data assumptions and tool modifications required to assist with modelling future gas supplies, storage and demands in general to assist with the creation of the local energy plan.

WP5G – Gas network Analysis for trial areas

This work package covered using the newly modified Gas network analysis tool to analyse the impact of the Local Energy Plans on the gas network and develop Network investment options. However it became apparent that under the given scenarios, with the given scale of the analysis while there were some areas of local growth of gas demand, these tended to be balanced, or exceeded by the reduction of gas demand in the scenarios as boilers were replaced by heat pumps. This resulted in scenarios that required no upgrades to the existing gas network as it already had sufficient capacity to manage the required throughput. In order to test the process, new scenarios were added to reflect the development of hydrogen networks so that the process to upgrade the analysis tools could be tested.

WP5E – Electricity network analysis for trial areas

This used the tool developed in WP4E together with the upgraded NIFT to analyse electricity networks associated with the three primary substations associated with the trial areas and provide the output files including the investment options and associated metrics to the CBA tool.

WP6 – Integrated plan development with stakeholders

The Open Networks WS CBA tool that was selected and enhanced in WP3 was used with the network analysis output files to compare the results for each use case and related sensitivity run to draw out the learning in a series of use case reports. While it had originally been envisioned that the key parties would then identify trade-offs between their own proposed investments and adjust the timing and inclusion of investments within an integrated plan, it became evident that this approach would not be fully possible given the large number of investment options being proposed from the electricity network modelling and that no investment options were required by the gas network analysis and there were no clearly defined investment options being proposed by the local authorities as it was too early in their planning process. However, the Use Case Learning reports that were produced for each use case were presented to the local authorities to enable them to select their desired approach for EV charging, energy efficiency, heat pump deployment etc. which would then be reflected in the production of the LA’s LAEP and other strategic planning. As the investment options associated with each use case have been provided, these are in effect a set of investment plans and the LA selects that which it wants to apply.

WP7 - Evaluation & Learning report

In addition to the Use Case Learning Reports, the various elements of the project were evaluated, such as the degree of added value from the Integrated Investment Plan compared to the original separate plans, whether the results suggested any shortcuts that could be made in future iterations, project management learning etc. were captured in the Evaluation and Learning report.

WP8 – Dissemination & Closedown

The results of the project were shared via a dissemination webinar and publication of the set of learning reports.

6. Performance Compared to Original Aims, Objectives and Success Criteria

Objectives

Objective	Status	Performance
Develop a standardized process that can be used with different local authorities to create a local energy plan.	Complete	The process was devised over a series of workshops and documented in the deliverable of Work Package 2. It is published on the EPIC website.[3]
To create energy plans for the three trial areas	Complete	Energy plans have been created for the three trial areas which used disaggregated DFES data which was further refined following workshops with the local authorities relevant to each trial area.
To determine how to reflect the local energy plans in the DFES used for network planning purposes	Complete	The DFES building blocks to be used for network planning have been agreed including which items should be disaggregated to distribution substation or HV feeder level. The method to include dummy substations to model HV feeder disaggregated items has also been developed.
To disaggregate the DFES data to support LV and HV planning	Complete	The appropriate level of disaggregation of the DFES building blocks has been determined and metrics for disaggregation to HV feeder level have been provided.
To develop a tool to support automated analysis of HV networks and suggest network remedies	Complete	The HV Network Assessment Tool has been developed by PSC and has been tested and refined for use on the project.
To analyse the HV and LV networks associated with at least one primary substation in the trial areas and provide a view of the network and non-network solutions under different investment strategies	Complete	The LV networks in the trial areas have been assessed using the NIFT this has included the selected primary substation for each of the three trial areas but has also included other areas where the results have been compared to determine how consistent results are in different areas. The HV networks for the three selected primary substations were also analysed.
To develop a tool to allow the investment plans for electricity networks, gas networks and the local authorities to be compared to identify potential synergies	Complete	The Cost Benefit Analysis tool developed by the ENA as part of the work for the Open Networks project has been adapted for use by the project and formats for input data files have been agreed so that the NIFT and HV NAT can provide the agreed data in the appropriate format. A set of standard comparison charts

[3] EPIC Process Design & Trial Plan

Objective	Status	Performance
		has been produced to reduce the effort required to analyse the different use cases.
To use the tool to create an Integrated Investment Plan in the trial areas.	Complete	The tool was used to compare different options for the use cases and sensitivity variants. However due to the lack of investment options from the local authorities or gas DNO the investment plans that were input into the CBA tool reflected the required investments on the electricity network rather than being an integration of investments of all parties as originally intended.
To refine the processes to reflect the learning gained during the project.	Complete	Learning from all of the stages in process has been captured and included in the learning report, including recommendations for how to modify the process if it were to be repeated.

Success Criteria

Success Criteria	Achieved	Performance
The process to create investment plans jointly between electricity and gas utilities and the local authority will have been developed.	Yes	A six stage process has been developed and has been used within the project.
The process will include flexibility and other non-network solutions as options to alleviate network constraints.	Yes	The modelling within the HV NAT has included flexibility as a solution and the NIFT includes a set of other smart non-network solutions. The NIFT does not include flexibility as a solution, however as distribution transformer upgrades are modelled in the HV NAT for top down analysis this provides a useful insight. At the moment the modelling of flexibility services to resolve constraints on distribution transformers is somewhat speculative as at present the cost and effort required to transfer flexibility services to this level is prohibitive.
The process will have been applied to develop joint plans for at least three trial areas.	Yes	Energy Plans have been produced for all three trial areas and workshops to support the development of investment plans are underway.
The process will have been refined to reflect learning from the real-world use	Yes	The process has been refined in terms of how data is prepared and processed, how the systems integrate with each other and ultimately how the process supports the Local Authorities. Rather than providing a definitive set of proposed investments, at this stage it appears to be more useful to test different use cases with a view to informing policy decisions for all parties with a view to providing detailed investment information once there have been the improvements required to data quality and automated processing.
The process will have been assessed in relation to the LAEP method document and/or	Yes	The LAEP method document has been used to assist designing the process and to suggest sensitivity analysis requirements. Since then the learning and

Success Criteria	Achieved	Performance
subsequent guidance from Ofgem regarding Local Authority Energy Planning		experience from EPIC has been fed into the various workshops held by Energy Systems Catapult looking at Local Area Energy Planning. Comparison to the outputs of that process show a very similar process to EPIC with similar stages for allocating roles, determining the required data, carrying out analysis etc.
A plan development support tool will have been developed to assist with the appraisal of investment options and to provide the evaluations necessary to improve plans e.g. by changing investment combinations, scale, timing etc.	Yes	The Cost Benefit Analysis tool provided via the Open Networks project has been investigated and the functionality developed will be adapted to the needs of the EPIC project.
An HV network analysis automation tool will have been developed so that real network issues can be identified for the energy scenarios and variants.	Yes	The HV NAT has been developed and used to analyse the networks in the test areas.
The support tools will have been refined to reflect learning from the real-world use.	Yes	The CBA tool has been adapted to include standardised charts and to include standard file imports
The impact of different investment strategies i) “just in time” at point of need investment, ii) “One touch” future proof investment and iii) anticipatory or strategic investment will have been assessed.	Yes	The network analysis has been able to determine the impact of different investment strategies – Just in Time and Fit for the Future. Both of these strategies only upgrade the network at a point where an issue has occurred. Anticipatory investment can be modelled by altering the network model but this was not considered to be significantly different to Fit for the Future as there would need to be a degree of confidence that the investment was required, therefore it would likely have the same assets upgraded but a year or two earlier. The benefits from the jointly created plans compared to the individually created plans were assessed.
The benefits from the jointly created plans compared to the individually created plans will have been assessed.	Yes	This is supported by showing the relative benefits of one option to another within the use case analysis. The benefits of these are given in the Use Case Reports. However, as already explained, it has not been possible to assess the benefits of jointly assessing investment options from all parties.
The learning from the project will have been collated into a report and disseminated.	Yes	The dissemination webinar has taken place and the webinar slides and learning reports are published on the EPIC website.[4]

[4] EPIC Project Webpage

7. Required Modifications to the Planned Approach during the Course of the Project

Lack of Gas Network Investment Options

The analysis of the impact of the scenarios on the gas network showed that while there were areas of local growth, due to the scale of the areas being analysed the growth was always offset by reduced gas consumption elsewhere in the zone. With gas networks seeing the same or lower volumes of gas, there was no requirement to reinforce the gas network and therefore there were no investment options for the gas network produced.

Lack of Local Authority Investment Options

Local authority proposals were also not as detailed as expected and while the local authority expectations were captured in the modified DFES values, we were not able to create investment options for local the local authority to be included in the integrated investment plan in the way that was originally envisaged. It appears that the EPIC project was a little too early compared to the development and refinement of the local master plans by the local authorities. It would be expected that the Master Plans would include specific development proposals which could be presented as investment options and were we to repeat the process in a year from now this would not be expected to be an issue. However the SPA specific use case which allowed for the inclusion of greater ground mounted solar was very similar to what we were expecting as an investment option, but with more confidence in the scale and location of the development.

Integrated Investment Plan

The original concept of an integrated investment plan was that investment options would be combined from the electricity DNO, Gas DNO and local authority and then the best overall strategy would be pursued. However, as outlined above, ultimately the investment plan was very focussed towards the outputs from the electricity network analysis. Therefore each set of outputs for the different analysis runs reflected a potential investment plan. To maximise the learning from the work package, the analysis shifted emphasis to include more detailed comparison of the use cases and sensitivities to provide a set of use case reports. This shift from the consideration of individual investments to having greater understanding of the use cases was of more use to the local authorities as it could support policy decision making. The latter workshops with the local authorities were therefore used to feedback the results of the use case reports and the general learning from the project rather than to agree a particular investment plan. However, given that the ongoing negotiations with Ofgem over ED2[5] allowances, any plan could only have been agreed in high level terms and it would not be possible for National Grid to guarantee that the timing of the particular investments would be followed, given the reactive nature of work on the 11kV and LV networks.

Additionally there were some minor changes to project plan dates that were handled during the project using the normal change control process.

[5] ED2 is the price control period for electricity distribution covering the period 2023-2028

8. Project Costs

Table 8-1: Project Spend

	Budget (£)	Actual (£)	Variance(£)
Regen Overall Process development, Local Authority liaison, data preparation, investment plan tool assessment and development	£92,300	£92,300	£0
EA Technology NIFT development, network analysis, involvement with workshops, learning capture and dissemination.	£41,500	£50,070 (£50,070 = £41,500 budget + £8,570 from contingency)	£8,570
PSC HV NAT development and use of HV NAT to analyse HV networks, involvement with workshops, learning capture and dissemination.	£201,377	£201,377	£0
NGED Project Management	£83,661	£94,960 (£94,960 = (83,661 budget + £11,299 from contingency)	£11,299
Contingency	£41,884	£19,869	£22,015
NGED Subtotal	**£460,722**	**£438,707**	**£22,015**
WWU Project Management	£79,733	£79,733	£0
Project Total	**£540,455**	**£518,440**	**£22,015**

The costs for EA Technology were increased after the scenarios to be modelled were agreed. It had originally been assumed that the NIFT would be able to model the selected scenarios however the methodology for modelling energy efficiency improvements was more complex and required additional development and testing. The project management costs for NGED were overspent due to additional project management time being required during the project, especially in relation to data provision for the HV networks analysis tool and resolution of data quality issues. The degree of contingency spend at approx. £20k is within the contingency allowance of approx. £40k so the project as a whole, including contingency is under the original budget by approx. £20k.

9. Lessons Learnt for Future Projects and outcomes

The learning from the EPIC report has been captured and shared in a variety of ways.

1) The workshop with the local authorities to provide feedback on the results of the analysis.
2) A set EPIC use case learning reports.
3) A report covering the learning from NIFT development tool and LV results analysis
4) A report covering the learning from the HV NAT development and HV results analysis
5) A separate Evaluation and Learning report covering project learning

6) The final project dissemination webinar

Items 2-6 are available on the EPIC Project Web-page.

A summary of the key points has been included here but please refer to the other documents for full details.

Workstream	Learning Detail
WP1 Trial Area Selection	• Careful consideration of what needs to be included in the Strategic Planning Area (SPA) i.e. the area to be analysed with the EPIC Process. This boundary is critical and will be influenced by a variety of factors including location of significant new developments and the boundaries of the Electricity Supply Areas (ESA), which is the area supplied by a primary substation, and the boundary of the Gas Supply Area (GSA) the smallest area of the gas network that can be modelled in isolation. It is likely that the GSAs will have the biggest influence over area selection with the ESAs being selected manually to create the most complementary boundaries. • As part of the process to define the SPA boundary, several datasets will need to be examined and it will be useful for future users of the process to request these from the networks upfront. • Effective stakeholder engagement will be a cornerstone of the success of any project using the EPIC process and a stakeholder map and engagement plan is likely to be very useful.
WP1 Trial Area Selection and Initial Data Gathering	As part of the work to define the SPAs, it was necessary to examine and analyse several datasets, many of which came from National Grid and Wales & West Utilities. These included: • High Voltage (HV) network topology • Low Voltage (LV) network topology • Customers by postcode at LV substation • Location of LV feeders and upstream network topology • ESAs from the National Grid DFES • Definition of gas supply areas from Wales & West Utilities • National Grid DFES data by local authority and primary for SPAs • New build phasing, sites, and network connection voltage/location • Typical energy consumption values by primary and profile class[6] In common with a lot of projects, gathering this data took longer than anticipated and required a good deal of iteration between the project partners, networks and local authority stakeholders. Future users of the EPIC process may benefit from requesting this data from the relevant electricity and gas network upfront to streamline the process. Significant efficiencies would be obtained for future use of the EPIC process if the main data elements were already prepared and available. A complete package of data requirements could be defined up front and provided digitally. Standard formats and processes for regional data exchanges are under investigation as part of the Open Networks project, Work Stream WS1b P4

[6] Profile Classes are used by Elexon to categorise customers into eight groups for settlement purposes. More information is available here https://www.elexon.co.uk/knowledgebase/profile-classes/

Workstream	Learning Detail
WP1 Data Quality	The quality of network data did cause problems during the network planning phase of the project. This is discussed further in Work Package 5 and Work Package 6. At present while it is known that there are general data quality issues, there are no metrics to indicate areas which might have better or worse data quality to help the process of area selection. As part of the process of improving data quality it would be helpful to: • Determine what metrics would help with area selection and/or network analysis; • Provide metrics at a suitable level of resolution; and • Provide a plan for quality improvement so that this can be reflected in any scheduled analysis. Future EPIC deployment should cover all network assets within each strategic planning area, but if possible, a rolling schedule of plan updates should be agreed so that DNOs do not need to support all Local Authorities at the same time.
LV Tool Specification	The learning points from WP2 in relation to the LV modelling tool were: • Agreeing the format of the input and output files from the different modelling stages was beneficial as it allowed all parties to develop the correct templates in advance, reducing risks at the analysis stage. It was possible to keep a degree in flexibility about some of the processes at the specification stage whilst still agreeing data formats. For example, the exact methodology to be used to calculate spare capacity in each year was not defined at the specification stage, merely that a column would be included on the data sent to Regen for the CBA. • An existing tool was used for project EPIC, rather than developing a bespoke solution. This reduced costs overall, and would mean that the same tool could be used for other areas of WPD's network relatively easily (although with the same issues as were present in project EPIC). There were some downsides to this, principally: – Poor data quality in relation to the existing network. This led to an unrealistically high proportion of the network appearing to have constraints in the baseline year (i.e. before significant LCT uptake). This effected most use cases equally but has the largest impact on the timing and total cost of network investment. – Some amendments to the existing system were required to meet the requirements of project EPIC. – Separate post-processing needed to be developed in order to convert the standard NIFT outputs into the necessary metrics for the CBA. Bespoke graphing was also created to compare scenarios and report on the results for the LV Learning and Evaluation Report. In the future it would reduce the time required if a standard set of output reports/views for each implementation of the EPIC process was agreed, rather than producing a bespoke set of reports.
Energy Plan development	• Active local authority engagement is critical to the success of gathering the data required to generate accurate local energy plans. Continued, regular engagement is crucial and building sufficient time into the project plan to allow local authority stakeholders to refer to published (or draft) policies between the two workshops could be advantageous for future users of the EPIC process to ensure that the local energy requirements plans are as accurate as possible. • To develop a fully integrated plan it is necessary to have local authority plan data and defined energy policies. This could come from a LAEP type process that would proceed EPIC. • Where published (or draft) policies and local planning data are not available, using the existing DFES data as a baseline for discussion was incredibly useful.

Workstream	Learning Detail
	• Use cases provided a useful starting point for network analysis and options appraisal. The number of use cases and sensitivities needs to be balanced against the increased network planning resource that is required. • Networks should continue to develop customer behaviour and demand profile data. • Existing stakeholder engagement with stakeholders, should be extended to capture potential future use cases that may require modelling so that the future tool development can take place with those option in mind. For example it may be that there is value in modelling the use of electrical battery storage, thermal batteries, LV connected flexibility etc. The future increase in loads from EVs and Heat pumps may require the analysis tools to not only recognise breaches of thermal and voltage limits as triggers for reinforcement, but to also recognise where parts of the network that previously supplied under 1MW of peak load are likely to exceed it, triggering additional fault resilience requirements under Engineering recommendation P2/7.
WP3 – Investment and Options appraisal tool development and testing	• The use of the WS CBA tool saved time and gave confidence that best practice was being applied. For future CBA studies, use of pre-exiting tools should be considered before any tool development. • For user-defined financial metrics (e.g. WACC, capitalisation rate etc.), it's important to ensure the most up-to-date and accurate values are used as these will change with time. • The functionality of the CBA tool should be understood as it relies on having good inputs from network analysis tools, the focus should be on generating these. • To ensure compatibility of network analysis tools with the Whole Systems CBA tool, it would be useful to pre-define a live "EPIC CBA inputs" workbook where the outputs of the network analysis tools can be stored for effective data integration with the CBA tool. This would minimise the data manipulation required by the 'EPIC energy planner' and would be the most efficient way to collect and input the required data into the CBA tool. • To support potential future use of the CBA tool by a wide range of local authorities that may have differing views on which metrics to include in the tool, stakeholder engagement should take place to determine if standardised sets can be used. • Future users of the EPIC process may want to align an approach to reference and locate network demand in the gas and electricity network analysis models. Although a postcode approach was used in project EPIC, a database based on UPRNs or a combination of gas and electricity meter numbers could ensure more effective, common language that is relevant and meaningful for both the gas and electricity networks. • For technologies that impact both the gas and electricity networks, it is essential that the same forecasting methodology is used for these technologies by both networks and early agreement on an appropriate forecasting approach will be useful.
WP 4 HV NAT development	• It had been assumed that the "gaps" between the bottom up and top down analysis, due to distribution substations that could not be modelled within the NIFT and HV connected customers would be simple to fill but this process ended up being very time consuming. This highlights a general point of requiring good quality data to support automated analysis processes. • Similarly the SINCAL network model that was used did not support network analysis one feeder at a time as parts of the model HV feeder attribution were missing. This meant that the network model did not include details of the HV feeder that each cable, transformer or item of switchgear formed part of and that models for each HV feeder from the source circuit breaker to the normal open points could not easily be generated. Modelling each HV feeder separately is expected to have benefits in terms of speed of modelling.

Workstream	Learning Detail
	• In order to improve processing times, hourly rather than half hourly analysis was used and comparison of the results showed that this improved running times without detrimentally affecting the results.
WP 5 Gas Network Analysis tool development	• The Gas network analysis tool is still under development and now has a focus on understanding the gas network impacts of a switch to hydrogen rather than whole system integration with electricity systems. • Aligning the areas used for DFES disaggregation and gas networks was hampered by comparing postcodes with lat/long systems. This also flagged up the need to track postcode changes. • The maximum reduction in peak gas demand across all scenarios and SPAs was 13% but information wasn't available for network analysis to determine whether this was because of local growth from new developments being outweighed by reductions in load via energy efficiency and / or switching to heat pumps. As a result it wasn't possible to identify the reinforcement that would be needed for new developments or any decommissioning if whole areas were moved to other technologies. In order to provide an opportunity to follow a process for gas network analysis and costing, work was done to generate dummy reinforcement based on arbitrarily modelled demand increases, or a change in the properties of the gas being transported, even though this wouldn't influence the CBA or the integrated investment plans for this project. • A limitation of the current gas analysis tool is that it does not export any cost outputs. Reinforcement solutions (such as parallel pipes, links or new governors) are arrived at through an iterative process then manually exported. The costing of these solutions is currently undertaken as a distinct activity because unit costs can vary considerably depending on the location of the scheme. It may be beneficial to the EPIC process to explore whether the analysis tool's functionality can be broadened to address this. • There was a lack of data on heat pumps and the evolution of boilers and other assets to use hydrogen over longer timescales which limited the hydrogen modelling that could be carried out. There is a need for profiles for hydrogen variants and a longer term view of prices and carbon intensity of gas vs. electricity.
WP 5 HV Network Analysis	• The SINCAL model contains cables with no thermal rating information as this has been sourced from the Geographic Information System (GIS) data. Using a value of 99A allows us to prevent the tool over-reporting the required investment upgrades. • At Bower Ashton primary, renumbering of the circuit breakers has taken place following work a year ago, however while CROWN and EMU (National Grid's GIS system) are consistent, there was no update to the datalogger (a time series database used in National Grid) information making it very hard to interpret which logger relates to what data. This resulted in what was really a transformer load being shown as if it were the load of an outgoing HV feeder and vice versa. This suggested incorrectly that the transformer was very lightly loaded and that the HV feeder was severely overloaded. There does not appear to be a way to make the datalogger labels time-sensitive and reflect the labels that were valid at the time. • A number of HV connected sites do not have Meter Point Administration Numbers (MPANs) associated with them but appeared to be operational and this was confirmed using other systems such as PowerOn to determine whether the HV site was energised. In most cases it was not possible to identify the related MPAN and this was an activity that could not be automated. • The SINCAL model generates dummy transformers of 100 kVA capacity at the locations of HV connected customers. These would have been likely to create investment upgrades on non-existent transformers. Similarly these will introduce an impedance which is not correct for network modelling. These were corrected for EPIC. • The initial models for the primaries had a number of disconnected sections of network, only one of which was genuine. One was 33 kV network associated with the

Workstream	Learning Detail
	primary but without a source, another was reflecting a GIS error and the GIS also had the Normally Open Point (NOP) in the wrong place. This is the kind of issue which the Integrated Network Model (INM) will help with. • The lack of HV feeder attribution in the underlying network model has resulted in the HV NAT needing to model an entire primary at a time rather than modelling each HV feeder separately. It is possible that this is slowing down the overall processing time for the tool but it can't be confirmed without having a comparable network model and changing how the HV NAT operates. This should be investigated as we are likely to make use of more automated network analysis in the future. • The HV NAT running time was very slow, partially due to the number of nodes being processed in SINCAL. There were amendments that were made to speed up the process without compromising the results. One was to carry out analysis for 120 half-hour timesteps rather than 240 half-hour timesteps in the time series reflecting the representative days i.e. hourly rather than half-hourly analysis. This had no major effect on the investment required. Similarly, calculating Capacity Health Index (CHI) in the same power flow analysis, in which Network Investment (NI) and Flexibility Service (FS) calculations were carried out, saved time rather than carrying out the same power flow multiple times. • Originally it was planned to calculate the diversity factor between HV feeders and the primary transformer because the way in which the primary transformer replacement is calculated is to assume overload if the total profiles exceed 50% of rating but this is a bit pessimistic as not all HV feeders experience their most onerous conditions concurrently. This could be adjusted for by altering the point at which assets are considered overloaded. • Very high increases in annual demand values due to the EV building blocks were found to be the result of a problem where the load added was incorrectly multiplied by the number of chargers, overestimating the demand as a result. The calculation of EV loads is currently complex and a simplified process with typical profiles for different chargers would be useful in the long term. This is an area which is likely to require further data gathering. Demand profiles for EV hubs have not yet been collected as part of DNO network innovation projects to date, and in any case, profiles are likely to change as increasing EV uptake increases the utilisation of chargers. • In the distribution substation to primary mapping data there are certain distribution substations which appear twice in it but with different distribution transformer rating at the same site. This duplication was removed to ensure HV NAT reads the correct value of transformer rating at the concerned site. The cause of the duplicated results is not known. • The HV connected sites had no transformer rating data with all of them reading zero. This is correct as unless we have details of customer equipment the site will not contain National Grid owned transformers. However this resulted in issues with the disaggregation approach which was based on transformer ratings. Therefore, transformers for HV connected sites was assumed to be 2 MVA so that they get disaggregated load in the top down approach. • The LV DFES data has got profile class (PC) information only for non-hybrid heat pumps i.e. a distribution substation had heat pumps allocated for PC1 and PC2 separately[7]. This profile class split information is used by EA Technology. As PC information is not needed in HV NAT this PC split was seen by HV NAT as duplication of heat pump volume allocation and only PC2 volume was getting picked up in the analysis thereby underestimating the demand due to HPs.

[7] Hybrid heat pumps (i.e. where gas is used for heating in some periods) were assumed to only be allocated to Profile Class 1 customers. Profile Class 2 is used for homes with electric heating (night storage heaters). It would be unusual to replace a home with electric heating with a hybrid heat pump requiring a gas connection.

Workstream	Learning Detail
	• The contribution to the demand by EVs reduces in year 2050 when compared to the contribution for year 2040. For the year 2050 there is a reduced volume of EVs in comparison to 2040 for both Dorchester St and Nailsea. This was initially considered to be a potential error, however Regen confirmed that this is on the basis of the assumption that there will be more utilisation of the public transport, car sharing schemes and autonomous vehicles, and hence less usage of EVs. • OPEX costs associated with modelled reinforcement (other than flexibility services) are not considered as part of the HV NAT due to the challenges in correctly identifying these in an automated fashion to impact the overall investment decision. • Upgrading of 6.6 kV cables to 11 kV cables was intended to be captured in HV NAT; however, it has been decided not to consider this upgrade programmatically but to consider it as a one off. Hence it is not considered in HV NAT. • The number of representative days in this kind of long term analysis can be reduced from five to three. The “Int_Warm” and “Summer MinGeneration” representative day recorded the least level of investment. Dropping these representative days would lead to lesser computational effort as the number of HH time steps reduces by a one fourth of the processing time. • Filton DC primary had issues in terms of quality of data. For a good part of the year, the incoming transformer data was missing
WP5 LV network analysis	• Feedback gained from the local authorities which participated in the EPIC project could be used to standardise the analysis – using a common set of data inputs and reporting. This would reduce the time required to generate input data, run multiple simulations and manually analyse and comment on the outputs. • The time taken to prepare, complete and analyse the results is much more dependent on the number of use cases/scenarios modelled, rather than the total number of substations. Where possible the number of scenarios should be minimised in order to reduce the costs involved. • The availability of accurate, high quality network data for the area to be studied is key. In this project timescales did not allow for an existing model to be updated, resulting in older, less accurate data being used. As digitalisation of network data increases the availability of accurate models of the network should improve, and this should be a pre-requisite for future modelling. • As knowledge about the operation of new technologies increases then this may provide the opportunity to improve the underlying demand profiles used in this type of network modelling, given greater confidence in the results. It is therefore recommended that in future innovation projects the opportunity is taken to collect and analyse the data to improve the profiles available for LV network analysis. This would benefit macro level modelling such as that undertaken in EPIC or for business planning purposes, and LV network design on a more local level.
WP 5 Assessment / Development of the CBA tool	• For user-defined financial metrics (e.g. WACC, capitalisation rate etc.), it’s important to ensure the most up-to-date and accurate values are used as these will change with time. • To ensure compatibility with the Whole Systems CBA tool, it would be useful to pre-define a live “EPIC CBA inputs” workbook where the outputs of the three network analysis tools can be stored for effective data integration with the CBA tool. This would minimise the data manipulation required by the ‘EPIC energy planner’ and would be the most efficient way to collect and input the required data into the CBA tool. • Future users of the EPIC process may want to align an approach to reference and locate network demand in the gas and electricity network analysis models. Although a postcode approach was used in project EPIC, a database based on UPRN (Unique Property Reference Numbers) or a combination of gas and electricity meter numbers could ensure more effective, common language that is relevant and meaningful for both the gas and electricity networks.

Workstream	Learning Detail
	• For technologies that impact both the gas and electricity networks, it is essential that the same forecasting methodology is used for these technologies by both networks and early agreement on an appropriate forecasting approach will be useful. • While it was intended to reflect the network benefit from reinforcement work that created spare capacity, it was very hard to specify a metric for this that could be applied consistently across the LV and HV networks and that did not have a value so large as to overwhelm the other benefits and costs in the network analysis. This was overcome by relating the metric to the change in capacity rather than reflecting the entire network capacity.
WP6 Use of the CBA tool to assess the use cases	• Despite the time taken to set-up and gain familiarity, the Open Network Whole System CBA tool proved itself very useful and could be more widely adopted. • There is a general need to improve the quality of (low voltage) network data and the assumptions underpinning LV network planning. • Care needs to be taken when applying "whole system" cost benefits to understand the relationship between different cost/benefit drivers, some of which may counteract each other. • While the CBA results were heavily dependent on area specific network conditions, more work to extend the EPIC analysis may enable planners to identify key characteristics and drivers to provide benchmarks and guidelines for energy planners. • Improved modelling of flexible Time of Use (ToU) tariffs is needed to better reflect how they would act to reduce peak demand. • The energy efficiency and 'Fit for the Future' results suggest that further work should be completed to articulate the benefits of either approach. • Flexibility services may become cost effective for managing HV and LV constraints when there is a larger pool of LV connected flexibility service providers, therefore features to support future flexibility services should be built into domestic EV chargers and batteries. • Given the similar costs of both EV charging scenarios, a policy that initially emphasises installing on-street charging points then moves to installing rapid charging hubs at a later stage is likely to be cost effective. • While hybrid heat pumps can reduce network costs, the exclusion from incentive schemes may result in this opportunity being difficult to realise. • DNOs should focus on improving the planning profiles used for distribution substations and use these for HV modelling with scaling factors applied as required.

10.The Outcomes of the Project

The outcomes of the project are as follows;

- The project has delivered the trial area selection report that outlines the trial areas that have been selected and their key characteristics.
- A combined planning process has been developed and documented. As part of the process to produce this, working documents have been produced outlining the data model, the approach to disaggregation, the options for sensitivity analysis and how energy efficiency impact can be modelled.
- The local energy plans have been created with the input of the local authorities which has involved a great deal of data preparation, disaggregation and the creation of dummy substations to support modelling.
- The NIFT tool has been adapted to allow for modelling of energy efficiency and to upgrade the analysis engine from WinDebut to Connect LV before being used to analyse the trial areas and generate results in a suitable format for the CBA tool.
- The HV NAT tool has been specified, developed, tested and used to analyse the networks in the trial areas. It has generated results in a suitable format for the CBA tool.
- The process to analyse the gas networks, determine the appropriate costs to be used and create suitable output files has been trialled.
- The project has highlighted some key areas where data quality is insufficient and would be problematic if the process were to be adopted at scale.
- The WS CBA tool has been configured with appropriate costs and metrics for benefits. The configuration allows for the analysis of multiple use cases and for output files from multiple network analysis tools. The CBA tool has also been enhanced by the inclusion of standard charts.
- The learning from EPIC to date has been fed into the workshops held by Energy Systems Catapult in February 2022 in relation to Local Area Energy Planning.
- The analysis has been carried out to understand the impacts of different approaches or values for each use case. Each Use Case has been analysed with the results written in a report.
- The combined learning for the project has been captured in the Evaluation and Learning report which includes recommendations for future work and for using the work and tools from EPIC. Learning has been shared via a webinar with interested parties.

11.Data Access Details

No new data was captured as part of the project but rather the existing DFES data was disaggregated to lower levels.

Some data was generated via the use of the analytical tools within the project which is available in the relevant published reports as follows;

- The results from the analysis within the LV NIFT tool are published in the NIFT learning report.[8]
- The high level results from the HV NAT are published in the HV Learning report.[9]
- The results from the use of the CBA tool are included in the EPIC learning report for WP7.[10]

[8] NIFT learning report
[9] HV NAT learning report
[10] Overall Learning Report (including CBA tool learning)

12.Foreground IPR

New foreground IPR has been created by PSC in the development of the HV NAT. This tool will be available to third parties however, but they will need to obtain suitable SINCAL licensing to use it.

New foreground IPR has been created within the NIFT tool development. This is available for use by third parties using the NIFT.

Additional foreground IPR has been created by Regen in the enhancements that have been applied to the CBA tool developed by the ENA. The upgraded version of the tool has been provided to the ENA for use by interested parties.

13.Planned Implementation

The EPIC process was intended to better coordinate planning between local authorities and energy network operators. There are a number of important pre-conditions that would need to be put in place before EPIC could be rolled-out as a business-as-usual process and offered more widely as a new network service.

1. Local energy plans and associated data would need to be made available. DFES data could continue to act as a useful baseline and input, but to properly add value a local energy plan would need to be developed.
2. The quality and robustness of network asset data and load assumptions needs to improve and it is recommended that data quality metrics are devised to assess the requirement for improvement and to confirm progress against targets.
3. The resources taken to run network analysis tools would need to be reduced.
4. The EPIC process would have to be scaled-up cover several primary substations, their HV feeders and LV networks

Potential value from EPIC process

While resource constraints are a concern, a resource heavy process can still be justified if this delivers net benefits. An assessment of the benefit in terms of reduced network costs by selecting the best option vs the worst option for each use case suggests that the NPV of benefits per primary up to 2050 could be in the region of £0.5m. It should be noted that this value does not include the cost of applying additional energy efficiency measures or the additional costs of installing hybrid heat pumps over regular heat pumps. However, it suggests that there may be value in supporting policy decisions that benefits all areas while modelling only a subset of the network or that if data quality and automation improvements significantly reduce the costs of performing the analysis the benefits could outweigh the costs.

It may take some time for the prerequisites listed above to be met, however there are elements of the EPIC process that can be adopted and re-used relatively quickly.

1.1. Bespoke EPIC process to inform specific policy choices

The use case learning was of value to the network companies and local authorities in terms of informing policy. This suggests that a bespoke EPIC type process could be used to inform certain policy decisions. It may be useful to repeat this type of analysis to determine the impact of other potential policy choices by either the local authorities or the network company e.g.

- What would be the impact of providing domestic battery storage to a cohort of customers?
- What would be the impact of deploying phase balancing equipment on LV networks?

1.2. Using network analysis tools – Strategic planning

The network analysis tools, HV Network Assessment Tool and the LV NIFT will be of value to the networks and could be applied across a number of different applications. The LV NIFT, for example, has already been used for WPD’s RIIO ED2 planning and could be a key tool to inform future use of Uncertainty Mechanisms.

Future development of these tools, for example to visualise and logically group a series of network upgrades, will help networks move from a reactive, piecemeal, reinforcement strategy to begin to make proactive investment plans. For example, upgrading logical groups of assets in a batch process and also implementing a more general “fit for the future” investment strategy.

1.3. Using network analysis tools – Opportunity identification

The automation of the network analysis means that batch processing to identify relatively rare opportunities can become feasible. For example, the LV NIFT tool has also been earmarked for use within the Defender project and be part of the toolset that can identify areas where energy efficiency is a legitimate investment. Similarly the HV NAT tool could be adapted to provide upgrade timelines for each asset in the study area over the study period to support decision making when assets are replaced due to their condition or age.

1.4. Using network analysis tools – Standard reports

There are some reports that if routinely produced, using the tools developed by EPIC, may be of use to network planners. These include;

1. Yearly investment over the study period horizon for each primary
2. Demand projection at the primary level over the study period
3. Which transformers replaced more than once over the study period (currently this requires manually reviewing non CBA output files from HV NAT to pickup which transformers get replaced more than once)
4. Which representative day triggers the upgrade of each asset
5. Which assets require flexibility services and which assets require upgrading in each year
6. New rating of the assets which require upgrading for each year
7. Value of the flexibility service in (MW and MWh) required for each asset for each year
8. Feeder which requires splitting and its corresponding year
9. Load profile (i.e. representative days) in MW and MVAR for each distribution substation for each year for the Top down approach
10. These can be used by several different business areas within WPD.

1.5. Exploring investment ahead of need

A process similar to EPIC could be used to demonstrate localised cases where there is significant investment required and there would be savings from adopting a planned programme for an area rather than repeated separate upgrades. This could support trialling alternative regulatory approaches that encourage longer term savings by encouraging early investment and share risk, reward and costs in a different way to the current framework.

1.6. Using EPIC processes alongside a LAEP process

As discussed in section **Error! Reference source not found.** of the Learning Report, EPIC could be used as an allied process to a full LAEP. In this approach LAEP would provide the overall energy plan and energy requirements scenarios, while EPIC would be used to conduct network modelling and options cost appraisal, to inform and confirm final LAEP actions, priorities and decisions. In order for this to work successfully the two process would need some alignment on the treatment of spatial data, mapping to network assets, and the use of common data building blocks.

Ultimately however EPIC could enable networks to play a more proactive and supportive role to enable LAEP studies to incorporate network impacts and costs into their whole system analysis.

14.Contact

Further details on this project can be made available from the following points of contact:

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15.Glossary

Abbreviation	Term
API	Application Program Interface
ASHP	Air Source Heat Pump
BU	Bottom Up
CAPEX	Capital Expenditure
CBA	Cost Benefit Analysis
CHI	Capacity Headroom Index
CI	Customer Interruptions
CML	Customer Minutes Lost
DFES	Distribution Future Energy Scenarios
DNO	Distribution Network Operator
ED2	Second price control period for electricity distribution under Ofgem's RIIO model covering the years 2023-2028
EE	Energy Efficiency
ENA	Energy Networks Association
EPIC	Energy Planning Integrated with Councils
EV	Electric Vehicle
FFF	Fit-For-the-Future
FS	Flexible Services
GDNO	Gas Distribution Network Operator
GDPR	General Data Protection Regulations (data protection)
GIS	Geographic Information System

Abbreviation	Term
GUI	Graphical User Interface
HH	Half Hourly / customers with Half Hourly electricity metering
HISTAN	Historical Analogue
HP	Heat Pump
HV	High Voltage (6.6 and 11 kV)
HV NAT	High Voltage Network Analysis Tool
INM	Integrated Network Model
JIT	Just-in-Time
LAEP	Local Area Energy Plans
LCT	Low Carbon Technology
LEP	Local Energy Plan
LPZ	Linepack Zone
LTDS	Long-Term Development Statement
LV	Low Voltage (0.4 kV)
LV NIFT	Low Voltage Network Investment Forecasting Tool
MPAN	Meter Point Administration Number
NGED	National Grid Electricity Distribution
NI	Network Investment
NOP	Normally Open Point
NPC / NPV	Net Present Cost / Net Present Value
OHL	Over-Head Line
OPEX	Operational Expenditure
OPEX	Operational Expenditure
PC	Profile Class as used by Elexon to categorise customers
PSC	Power Systems Consultants
PSS®SINCAL	Power System Simulator for Siemens Network Calculation
SCADA	Supervisory Control and Data Acquisition
SPA	Strategic Planning Area

Abbreviation	Term
TD	Top Down
TOTEX	Total Expenditure
ToU	Time of Use
UPRN	Unique Property Reference Number
WACC	Weighted Average Cost of Capital
WECA	West of England Combined Authority
WP	Work Package
WS CBA	Whole System Cost Benefit Analysis
WWU	Wales and West Utilities