Energy Networks Association

Open Networks Project

Future Worlds Impact Assessment Consultation Webinar

27 March 2019
Thank you for joining the Future Worlds: Impact Assessment Consultation webinar. This webinar will commence at 3:03PM.

• If you are unable to play the audio through your device, you can also dial in by calling +44-20-3478-5289 and entering access code 842 913 999 when prompted.

• Please ensure that your microphone is switched to ‘mute’ to avoid background noise and your camera is not in use.

• You may ask questions via Q&A function (as opposed to the chat function) throughout the webinar. We will address as many of these as possible at the end of the presentation.

• Please note that this webinar will be recorded and that the audio, chat messages (anonymised) and slides will be made available on our website.

Should you want further information about the Open Networks project, please don’t hesitate to get in touch with us at opennetworks@energynetworks.org


The consultation closes on 1st May 2019. Please send your responses electronically to opennetworks@energynetworks.org
## Agenda

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Open Networks – Delivering a Smart Grid

ENA’s Open Networks Project is a major energy industry initiative that will transform the way that both local Distribution Networks and national Transmission Networks will operate and work for customers. This is being driven by the 3Ds; digitisation, decentralisation and decarbonisation.

The Open Networks Project will help customers connect and realise value; as well as reducing cost for consumers through more cost effective planning.

The Open Networks Project is a key initiative to deliver Government policy set out in the Ofgem and BEIS Smart Systems and Flexibility Plan, the Government’s Industrial Strategy and the Clean Growth Plan.

We are taking a ‘learn-by-doing’ approach; we are using innovation funding to trial and test aspects of the various future electricity system options.

Short Animation that can be found at: https://www.youtube.com/watch?v=8GxeWsppmBI
The Open Networks developed five potential market, organisations and operational industry structure known as Future Worlds in 2018 through a substantial stakeholder engagement process.

These Future Worlds represent a range of industry architectures that are capable of delivering UK’s transition to a smart flexible energy system. These worlds are differentiated by the respective responsibilities of the DSO, ESO and other entities in accessing and utilising flexible DER to operate the electricity networks.

Following a consultation on the Future Worlds in 2018, the project commissioned Baringa as independent consultants to carry out an impact assessment to assess the relative costs, benefits, strengths and weaknesses of the Five Worlds.
Launched on 6th March, this consultation aims to give stakeholders the opportunity to provide direct input into the Baringa’s impact assessment work and help shape next steps for the transition to DSO.

This consultation is designed to stimulate and guide discussions within the industry and between stakeholders on the various models emerging DSO role and effective coordination of DER.

Our finalised impact assessment post-consultation will be a key output that will contribute to the ongoing development of DSO Transition and input into policy in a decentralised, decarbonised and digitalised energy landscape.

## Consultation Questions

### General

**Q1.** Please confirm which stakeholder groups you believe that you belong to; this will enable the Open Networks Project to understand the spectrum of respondents to this consultation.

**Q2.** Please provide your views on Baringa’s interpretation of the Future Worlds, detailed in Section 2, for the purpose of this impact assessment and the overall approach, highlighting any key strengths or weaknesses, or areas which should be explored in more detail.

### Executive Summary

**Q3.** Do you agree with the conclusions and insights within the Executive summary? If not, explain your rationale. Please provide reference to more detailed comments against individual sections if this is appropriate.

### Transition Paths

**Q4.** Do you agree with the options set out as potential transition paths?

**Q5.** Do you believe there are any other viable transition paths? If so, please explain why.

**Q6.** Do you agree with the assumption that all transition paths start in Stage 1 of World B?

### Further Work

**Q7.** Do you agree with the areas identified for further work in the 2019 workplan and the further work ideas in the impact assessment or do you feel there are other areas of work that should be prioritised to progress in this area?

**Q8.** What future work do you believe would enhance the debate and body of evidence around transitioning to the potential Future Worlds?

### Benefit Assessment

**Q9.** Do you agree or disagree with the four categories of system operation benefits identified? Are there areas that should be excluded from the list and/or other areas that should be included?

**Q10.** Do you agree, disagree on the key benefits assumptions contained within Appendix B (e.g. all Worlds, apart from World C, achieve the same benefits by 2050 etc.) and used in the impact assessment? If you disagree, please explain your reasoning. Do you have any other comments?

**Q11.** Do you agree or disagree on the approach used to assess the overall potential benefits of improved system operation?

**Q12.** Do you agree with the assessment of the proportion of benefits which each Future World is capable of delivering in Stage 1 and Stage 2?

**Q13.** Do you agree or disagree on the approach taken to deal with the uncertainty/range of benefits? If you disagree please explain your reasoning.

### Qualitative Assessment

**Q17.** Do you agree with the trade-offs of each of the Future Worlds identified against each of the high-level criteria in Table 1 of the Executive summary?

**Q18.** Do you agree or disagree with the Appendix A approach of ranking of worlds to help identify the strengths and weaknesses of each World against each criteria? If you disagree please explain your reasoning.

**Q19.** Do you agree or disagree with the rankings and whether they are suitably justified? If not, please comment on which ones and why?

**Q20.** Do you agree or disagree with the list of potential unintended consequences identified in Section 4.5, and their prioritisation and potential mitigation as charted in Figure 20? If you disagree please explain your reasoning. Should the Open Network project progress further work on unintended consequences?

### Cost Assessment

**Q14.** Do you agree or disagree with the areas identified for quantification of the implementation costs that will be faced by DSOs and ESO in Appendix C? If you disagree please explain your reasoning.

**Q15.** Do you agree or disagree with the approach used to assess the costs of each world? If you disagree, please explain your reasoning.

**Q16.** Do you agree or disagree with the approach to dealing with the uncertainty/range of costs? If you disagree please explain your reasoning.
ENA Future World Impact Assessment

Objectives, Approach and Navigating the Report
Introduction to the Impact Assessment and methodology

Background and context

▲ We were asked to undertake an **independent impact assessment of the Future Worlds defined by the ENA**

▲ This combined a **quantitative assessment of costs and benefits with a qualitative assessment** across wide ranging criteria, informed by stakeholder feedback

▲ We were **not looking to pick a particular World** but understand different strengths and weaknesses across a wide-ranging assessment

▲ The outputs of the work were intended to help with the following:
  • To provide an evidence base to inform the policy debate and support BEIS and Ofgem in its decisions
  • To identify current gaps in our understanding of the Future Worlds which may require further definition, trialling or investigation
  • To develop credible pathways, which may involve different combinations of Worlds and transitional stages

▲ We were tasked with completing the analysis and draft report by **end of December 2018 with final report in February**

▲ Where possible we have **incorporated responses to the Future World consultation** into the assessment
Introduction to the Impact Assessment and methodology

Summary of the methodology used for the Impact Assessment

**Quantitative assessment**
- Scenarios:
  - Scenario 1: Two Degrees
  - Scenario 2: Community Renewables

  - Modelling of total size of the prize for better system operation (benefit) for each Scenario

  - Map proportion of benefits to the Future Worlds

**Qualitative assessment**

- Qualitative assessment of
  - Customer experience
  - Environmental sustainability
  - Whole system optimisation
  - Market viability
  - Technical performance
  - Regulatory funding
  - Implementation risks
  - Industry structure and organisation

**Combined Impact Assessment**

This was designed to deliver a multi-criteria, relative assessment of the Future Worlds, under different scenarios out to the end of RIIO-2 (2030), 2040 and 2050

- It was designed provide insights into where costs and benefits fall across the different models
- The results and insights gained are captured in final report, geared to a varied audience
Introduction to the Impact Assessment and methodology

The Future DSO Worlds

- The Worlds were defined at a conceptual level and the potential data exchanges detailed within the SGAMs.
- We were seeking to read into the Worlds to understand how they will perform over time – requires some expansion on the existing definitions.

The Future Worlds

**World A**
- DSO Coordinates – a World where the DSO acts as the neutral market facilitator for all DER and provides services on a locational basis to National Grid in its role as the Electricity System Operator (ESO).

**World B**
- Coordinated DSO-ESO procurement and dispatch – a World where the DSO and ESO work together to efficiently manage networks through coordinated procurement and dispatch of flexibility resource.

**World C**
- Price-Driven Flexibility – a World where changes developed through Ofgem’s reform of electricity network access and forward-looking charges have improved access arrangements and forward-looking signals for Customers.

**World D**
- ESO Coordinate(s) – a World where the ESO is the counterparty for DER with DSO’s informing the ESO of their requirements.

**World E**
- Flexibility Coordinator(s) – a World where a new national (or potentially regional) third-party acts as the neutral market facilitator for DER providing efficient services to the ESO and/or DSO as required.

**Key assumptions used for Impact Assessment**

- We looked at two stages of development for each World – the timing of the stages can be different in each World.

- More complete definitions are available on the next slide but are summarised below.

- In World A, in the long term DSO will be responsible for managing the energy flows across the GSP, and aggregating flexibility on the distribution system to participate in balancing services/balancing mechanism.

- World C is based on price signals alone, which as a stand-alone world is hypothetical. Therefore it can be combined with all other Worlds (not just combined with World B). We have not defined World C in the same level of detail as in Ofgem’s SCR.

- Some Worlds cannot reach full coverage of DER in Stage 1 – e.g. In World D we assume that the ESO is not dispatching flexibility on LV networks in Stage 1 (aligns with stakeholder feedback).

- Defining World E as having multiple FCs (rather than one). In Stage 2 the FCs assume many of the SO functions, may evolving towards a regional ISO model.
**Introduction to the Impact Assessment and methodology**

**Summary of the Future World definitions used for the Impact Assessment**

The table below provides a fuller description of the definitions we used for the Impact Assessment with the **orange text** indicating the key additions from the original definitions.

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
</tr>
</thead>
</table>
| **World A** | • DSO co-ordinates the majority of flexible DER down to LV but there remains an option for the ESO to procure services directly.  
• The ESO provides the DSO with its residual requirements for flexibility services from DER. |
| | • The DSO becomes responsible for the co-ordination of all DER.  
• The DSO is responsible for managing flows across the GSP to meet ESO needs (both constraints and national balancing) as part of aggregating DER into national ESO markets. |
| **World B** | • Co-ordinated management of DER flexibility between ESO and DSO.  
• DSO constraints are generally prioritised as being met first where the DSO has no alternative resources. |
| | • As per stage 1 but with more detailed rules to co-ordinate dispatch of DER and manage a greater volume of DER on the system. |
| **World C** | • Increased choice in network access products and increased time of use and locational price signals down to HV with some static time of use at LV and simple access products. |
| | • Granular, dynamic price signals flow down to and including LV substation level. |
| **World D** | • The ESO co-ordinates all flexible DER down to HV.  
• Below HV the DSO relies mainly on asset solutions to manage the network (other than ToU charging signals). |
| | • The ESO co-ordinates all flexible resources down to and including LV. |
| **World E** | • There are regional Flexibility Co-ordinators which undertake all procurement of flexibility and undertakes the assessment of the costs of flexibility compared to the asset costs provided by DSOs and ESO.  
• The Flexibility Co-ordinators do not undertake dispatch of resources at this stage. |
| | • Regional Flexibility Co-ordinators now assume the role of dispatching DER resources to meet ESO and DSO needs.  
• In order to optimise dispatch decisions, the Flexibility Co-ordinators take on more operational responsibility. |
Energy Networks Association

Q&A
ENA Future World Impact Assessment

Results, Key Insights and Conclusions
Impact Assessment results

Context and background to understand the results

▲ There is a separate date for when each DSO World enters Stage 2 of development based on our assessment of what is required to reach Stage 2

<table>
<thead>
<tr>
<th>Maturity gap to Stage 2</th>
<th>World A</th>
<th>World B</th>
<th>World C</th>
<th>World D</th>
<th>World E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Business change required for Stage 2</th>
<th>World A</th>
<th>World B</th>
<th>World C</th>
<th>World D</th>
<th>World E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
<td>V High</td>
<td>V High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technology gaps to Stage 2</th>
<th>World A</th>
<th>World B</th>
<th>World C</th>
<th>World D</th>
<th>World E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage 2 implementation</th>
<th>World A</th>
<th>World B</th>
<th>World C</th>
<th>World D</th>
<th>World E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2028</td>
<td>2028</td>
<td>2028</td>
<td>2031</td>
<td>2036</td>
</tr>
</tbody>
</table>

▲ We have looked to apply a range to our results to reflect the uncertainty over inputs required to produce future costs and benefits

- A “pessimistic” range (high costs, low benefits)
- A “central” range (based on best assumption)
- An “optimistic” range (low costs, high benefits)

▲ We have also applied sensitivities to our results

- Treating World C as a layer in all Worlds
- Moving the timing of Stage 2 back for Worlds D and E
- A single, national flexibility co-ordinator (quoted in the report only)

▲ The quantitative assessment provides a lens on the DSO Worlds but the qualitative assessment is broader and provides a number of different insights into the relative strengths and weaknesses of the DSO Worlds
Impact Assessment results

Combined net benefits in 2030, 2040 and 2050, £m NPV (Community Renewables)

Interpreting the charts:
- The scale is different on each chart
- The black line represents the central assumption with the range shown around it
- World C is shown as standalone World
- Results are not very different in Two Degrees scenario

What the results show:
- Some differences in relative performance in 2030
- By 2050, the performance of Worlds A, B, D and E is similar
- Reflects the assumption that by Stage 2 each DSO World except World C can deliver all of the benefits
- Assessment illustrates that the largest benefits are from mid 2030s
- World C on its own performs relatively less well
Impact Assessment results

Impact on costs of combining World C with the remaining Worlds (£m, NPV) – central case

Interpreting the results
• Our benefits assessment illustrates that the benefits largely remain the same
• These show the extent to which price signals can help reduce the size and cost of system operation functions
• World E results are influenced by discounting effects as the investment comes at later date

What the results show
• The largest costs savings are in World E since this has the highest level of duplication of system operation functions
• The costs savings in World B are less since the DSO functions duplicated (system planning, network operations) are not reduced as much by integrating World C
Draft relative assessment results

Qualitative assessment

<table>
<thead>
<tr>
<th>Case</th>
<th>Stage 1</th>
<th>Stage 2</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Enhanced Customer Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fairness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affordability (delivers greatest net benefits)</td>
<td></td>
<td></td>
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<tr>
<td>Confidence and trust</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer benefit from markets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater environmental sustainability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilitates greater energy efficiency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilitates decarbonisation of generation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilitates decarbonisation of heat and transport</td>
<td></td>
<td></td>
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<tr>
<td>More electricity consumed closer to the point of generation</td>
<td></td>
<td></td>
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<tr>
<td>Economic Case</td>
<td></td>
<td></td>
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<tr>
<td>Financial benefits</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Expected benefits</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Whole system optimisation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Support whole system optimisation</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Optimises locally</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Brings more flexibility into the system</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Manages conflicts</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Avoids duplication</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Exploits synergies</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Commercial Case</td>
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<td></td>
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<tr>
<td>Market viability (ease of establishing new markets)</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Appropriate regulation (are regulatory frameworks in place)</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Financial case</td>
<td></td>
<td></td>
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<tr>
<td>Compatibility with Regulatory Funding</td>
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<td>2</td>
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<tr>
<td>Funding available to support market participation</td>
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<tr>
<td>Management case</td>
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<tr>
<td>Industry structure and organisation</td>
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<td>Level of rules and regulations required</td>
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<td>4</td>
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<tr>
<td>Delivers neutral fair, flexible and transparent markets</td>
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<td>4</td>
</tr>
<tr>
<td>Complexity of system operation</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Complexity of market participation</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Difficulty to implement for system operators</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Difficulty to implement for market participants</td>
<td>4</td>
<td>4</td>
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<tr>
<td>Future Proof</td>
<td>2</td>
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<tr>
<td>Technical performance</td>
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<td>Degree of safety risk</td>
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<tr>
<td>Service availability and reliability</td>
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<td>1</td>
</tr>
<tr>
<td>Physical and cyber security</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Resilience and recovery</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Clear dischargeable accountability</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Interpreting the results

- This is a relative ranking assessment
- Only looked for differences where they exist
- Many joint rankings
- Treated World C as standalone – against some of the technical criteria it is not appropriate to include World C
- Undertaken the assessment across Stage 1 and Stage 2 to understand the differences

Relative performance

- There are trade-offs between the performance of the DSO Worlds against different criteria
- No “clear winner”
- But very useful to understand the different strengths and weaknesses
- The 5 cases and sub criteria are helpful ways to draw some conclusions as to where strengths and weaknesses lie
Summary of qualitative assessment

High level summary of trade-offs

▲ The table below highlights which World performs best given different objectives and what the subsequent trade-offs are

<table>
<thead>
<tr>
<th>Most important objective</th>
<th>Likely World(s)</th>
<th>Subsequent trade-offs</th>
</tr>
</thead>
</table>
| Decarbonisation of heat and transport (particularly if this accelerates in 2020s)       | World A or B    | • Potentially more complex to operate (World B)  
• May require mitigations to be put in place for any perceived conflicts of interests |
| Ease of market engagement for existing flexibility providers                            | World D or E    | • Potentially less conducive to local (low voltage) energy markets in the short term  
• It takes time to implement which may impact the speed of decarbonisation in the near term |
| Lowest cost to implement and operate*                                                   | World D         | • Potentially less conducive to local energy markets in the short term  
• It takes time to implement which may impact the speed of decarbonisation in the near term |
| Minimise structural change from today                                                    | World B         | • Likely to lead to higher longer term costs compared to other Future Worlds  
• Greater complexity in system operation and dispersion of accountabilities across different actors  
• Potential frictional issues while co-ordination processes ‘bed down’ |
| Transparent, fair, neutral markets                                                      | World E         | • It takes time to implement which may impact the speed of decarbonisation in the near term  
• Likely to lose efficiency in decision making as information needs to be exchanged back and forth to the Flexibility Co-ordinators |
Key insights and conclusions

Wider observations

- **All of the DSO Worlds are likely to require a substantial increase in resources from today**

  Our cost assessment indicates that between 300-450 additional skilled people may be needed by mid 2030s across DSO, ESO (or Flex Coordinators)

- **New regulatory incentives may be required**

  There becomes a misalignment of investment costs and benefits in many of the DSO Worlds. For instance DSOs invest in monitoring equipment, stimulating markets and managing contracts to deliver benefits to the ESO. To make the business case for these investments, it would help to have incentives to recognise the potential to deliver benefits elsewhere.

- **Governance arrangements may need to be flexible to enable different regional pace of DSO transition**

  Different regions may need to move faster on the DSO transition path than others but current industry governance arrangements may prevent this

- **Market co-ordination**

  The emergence of DSO risks layering new markets onto existing ones with little co-ordination between markets – potentially leading to oscillating markets signals across different time frames. This would not conducive to stable system operation. Some DSO Worlds – A, D and E are based around a single entity which has the potential to optimise resources across different markets and to help provide some co-ordination across markets.
Key insights and conclusions

DSO Transition paths

We have looked to use the insights gained to consider what they mean for the DSO Transition.

We have identified four potential transition paths from today (assumed to be World B stage 1). There are different drivers and triggers which can drive industry towards each one.

Transition path 1

Transition path 2

Transition path 3

Transition path 4

Improved forward looking charging signals and access arrangements likely be a feature of all Worlds from 2023.

Low value in local flexibility markets due to low DER take-up or highly effective charging and access at low voltages.

High DER take-up makes co-ordination between DSO and ESO in World B problematic and it makes sense to optimise the system at distribution level.

Separate option to go down a more independent route from any of the Worlds.

Indicative timeline
Key insights and conclusions

Where further work could be useful

We have identified in the report two areas where further work may be useful:

1. **Work to inform the DSO Transition paths**
   - How can reformed price signals and access arrangements best support system operation functions to reduce costs?
   - What are the economics of local flexibility markets and LV flexibility likely to be for DSOs?
   - What are the potential conflicts of interest in Worlds A and B and how can they best be mitigated?

2. **Work to build on the Impact Assessment**
   - Defining the commercial arrangements for the DSO Worlds in more detail (particularly where risks sit)
   - Mapping responsibilities and accountabilities clearly in each World – particularly around system security and ‘war gaming’ scenarios
   - Understanding the network impact of different DER take-up scenarios (reinforcement requirements)
   - Improving the understanding of baseline technology costs for DSO
   - Understand the benefits of economies of scale across various DSO functions
We have published the models alongside our report.

Baringa report

Base case
- Master benefits

Final Future World results

Master costs

Integrated World C
- Benefits remain unchanged
- Integrated World C results included in Final Future World results

Master costs – integrated World C

Sensitivity: Later Stage 2 for Worlds D and E
- Later dates can be set in the Master benefits model
- Final Future World results_Sensitivity

Later dates can be set in the Master costs model
Energy Networks Association

Q&A
How to Respond

Should you want further information about the Open Networks project, please don’t hesitate to get in touch with us at opennetworks@energynetworks.org

Or

visit our webpage


The consultation closes on 1st May 2019 and feedback on the independent impact assessment is welcomed from all stakeholders.

If you would like to respond to the consultation, please submit your response to opennetworks@energynetworks.org.