ESO Technology Advisory Council

TAC-6

Date:	04/03/2022	**Location:**	Virtual
Start:	09:00	**End:**	12:30

The feedback captured during the meeting on the Axis collaboration tool can be found in the accompanying spreadsheet. This document summarises the feedback received verbally and via the Chat function.

All material from the meeting can be found on the ESO Technology Advisory Council website: https://www.nationalgrideso.com/who-we-are/stakeholder-groups/technology-advisory-council

Participants

Attendee	Organisation
Vernon Everitt (Chair)	Transport for London
Randolph Brazier	Energy Networks Association
Chris Dent	University of Edinburgh
Andy Hadland	Arenko
Naomi Baker	Energy UK
Alastair Martin	Flexitricity
Kate Garth	RWE Renewables
Simon Pearson	Energy Systems Catapult
Melissa Stark	Accenture
David Sykes	Octopus Energy
Anastasia Vaia	BP
James Houlton	Amazon Web Services
Chris Kimmett	Reactive Technologies
Claudia Centazzo	Independent
Judith Ward	Sustainability First
Jo-Jo Hubbard	Electron
Sonia Lalli (Facilitator)	Accenture
David Bowman	ESO
Norma Dove-Edwin	ESO

Jim Needle	ESO
Rob Rome	ESO
Simon Watson	ESO
Matt Hopkins	ESO
Gabriel Diaz	ESO
Ian Dytham	ESO

For specific agenda items

Attendee	Organisation
Fintan Slye	ESO

Apologies

Attendee	Organisation
Alvaro Sanchez Mirales	STEMY Energy
Fred Drewitt	Limejump
Teodora Kaneva	TechUK
Peter Stanley	Elexon
Graham Campbell	Scottish Power Energy Networks

Agenda

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1.	Welcome and introductions
2.	Minutes of last meeting and matters arising
3.	End of year message
4.	Feedback from the last meeting
5.	Balancing and Network Control roadmaps
6.	Update on the Product Model
7.	Discussion on the Balancing and Network Control roadmaps
8.	Subgroups update
9.	Next meeting and calendar
10.	AOB

Discussion and details

#	Topics discussed

1. Welcome and introductions

- The chair welcomed everyone to the meeting.
- Ulkira Wising has stepped down from the TAC. The ESO thanks her for her valuable contributions.

2. Minutes of last meeting and matters arising

- The chair noted that the minutes of the last meeting were agreed by circulation had been published on the ESO website.
- The feedback from the meeting has also been published on the ESO website.

3. End of year message

- Fintan Slye (ESO Executive Director) provided an end-of-year message.
- Fintan thanked the members for their contributions since the TAC was launched in December 2020.
- Fintan summarised some of the key pieces of feedback that the ESO had heard. These include:
  - The need for greater collaboration between technology and operational teams
  - Viewing transformational projects not just as technology projects
  - Focussing on delivering core-functionality that delivers well a more limited number of priorities
  - Learning from other sectors.
- Fintan acknowledged that the ESO needs to improve the way it demonstrates it is listening to and acting on feedback.
- Fintan provided an update on the ESO's delivery plans for 2025 zero-carbon operation ability ambition and noted current priorities including balancing costs, the balancing market review.
- Looking ahead to the government's ambition for fossil fuel free electricity generation by 2035, the ESO has identified three areas for further work:
  - The future resource portfolio that delivers net-zero system operation all the time at a reasonable cost for consumers and with expected levels of reliability.
  - The network and system considerations to transport electricity from sources of generation to demand.
  - The markets and services needed for net-zero system operation.
- Fintan said that the ESO was supportive of the current proposals for a Future System Operator.
- The ESO is looking at the risks to the energy system from the current events in Ukraine and considering the impact on colleagues in the ESO.

Discussion and Q&A

- The importance of DSO integration and agreement of primacy rules was noted.
  - Fintan mentioned that the ESO is currently updating its RIIO-2 Business Plan for the 2023-2025 period. An area of change is the increased work, and resource needed, for coordination with DNOs and DSOs.
- Current issues with Dynamic Containment (DC) performance monitoring were noted. The ESO team were commended for sorting this out quickly. The ESO should not move away from agile or delivering products to market quickly.
  - Fintan acknowledged the impact on customers and thanked members for their feedback. He reiterated that the aim is to learn from it and keep with the agile model.
- The industry as a whole may soon be asked to come up with immediate ways to take the pressure off the gas supply infrastructure.
  - Fintan said that the ESO was working with the rest of the industry on this.
- There is a risk that a number of separate DSO models and entities will be delivered without high-level strategic thinking about the vision, business models and how they will work together. The DSOs models will be funded on the basis of the RIIO ED-2 funding models currently being developed and there is a risk of sub-optimal regulation, similar to bus deregulation.

- Fintan acknowledged that the current approach has been led by the DNOs themselves with Ofgem and BEIS. The ESO's priority is to ensure a common and consistent interface between market participants, DSOs and the ESO.

4. Feedback from the last meeting

- The ESO summarised how it was acting on feedback from the last meeting which discussed the Enhanced Frequency Control project. This includes considerations around communication, security, market reform and rules, and learning from other countries.

5. Balancing and Network Control roadmaps

- Rob Rome (Director, Balancing Programme) outlined some of the changes to the energy landscape since the ESO submitted its RIIO-2 Business Plan in 2019. These include:
  - A different and faster changing generation mix to what was expected, especially with smaller distributed participants
  - A rapid reduction in large thermal units, particularly coal
  - Interconnectors moving to hourly gate closures, leading to increased volatility and large swings.
- This has resulted in the scheduling capability that the ESO needs changing. For example, there is more self-dispatching smaller units with less need to schedule larger units several hours ahead and an increased need to predict to significant changes much closer to real-time.
- The Balancing and Network Control programmes need to accommodate potential significant market reform, including locational marginal pricing.
- Due to this increased complexity, the Balancing Programme has stepped back over the last few months to consider the capabilities being developed and the delivery roadmap.
- Over the next few months, the ESO wants to work with industry on different options for enabling change to give the control room the capabilities they need and deliver market initiatives, and consider which systems (existing or new) that these changes are implemented in.

Discussion and Q&A

- There has traditionally been a need for synchronised capacity to provide headroom, which is often provided by thermal generation. Is this still the case – does the generation still need to be synchronised?
  - The ESO is always trying to keep its options open by having enough headroom and footroom on the system.
  - The ESO may want to synchronise plants to help us move within that range, but reliable fast-acting plants that are not synchronised are also suitable. But the control room engineers will be concerned that the plants may become unavailable due to participating in other markets, for example. This is one of the reasons why prediction rather than scheduling is becoming increasingly important.
- Any market participant up to final physical notification has the option to go to an alternative market, but the ESO can have confidence that a unit acting within its minimum non-zero time is going to be available. There may be a need to separate out synchronisation, which performs a commercial function, with performing a technical function.

Recap of the Balancing and Network Control programmes

- David Bowman provided a recap of the Balancing and Network control programmes.
- Since submitting the RIIO-2 plans, the estimated benefits case has increased by about 81% (although this is subject to change and final sign-off) and the overall benefits case for all the ESO's work has also increased.
- There have also been cost increases, particularly on the Balancing Programme, which will be discussed as part of the engagement.

Balancing Programme roadmap

- Matt Hopkins (Product Manager for Balancing Transformation) presented an update on the Balancing Transformation roadmap and progress over the past year since the topic was last discussed at TAC.
- The roadmap is in four phases. During 2021 the ESO completed the foundation and blueprint phases and is currently in the core phase. This will complete during 2022, and then move into the additive phase for the rest of the programme.
  - In the foundation phase, high-level requirements were gathered, pain points captured, and control room personas created.
  - In the blueprint phase, these were translated into key high-level epics and features. Some IT artifact, like development of conceptual solution architecture, was completed during this time.
  - In the current core phase, the ESO has taken one element of control room operation – bulk dispatch by a zonal balancing engineer up to 30 minutes ahead of real-time – and developed the major IT components for that. This is to prove that the IT architecture and the business concepts work as we would expect for a small part of control room operation.
  - These will then be built out during the additive phase and expanded to all elements of control room operation.
- The key strategic themes of the roadmap were presented. Two key ones are creating a scalable process for real-time balancing that can incorporate a far greater number of BMUs than present and the transition from the current systems to the new, including a period of parallel run.

Network Control roadmap

- Overall, the timelines are as presented at TAC-2 with the target dates met. Going forward, the new product will have a core service package delivered by April 2023 with modules added after.
- For the new product, wider engagement has taken place across the ESO and external stakeholders on requirements. A competitive dialogue tender process is currently underway to procure a largely off-the-shelf product with a minimal amount of bespoke additions.
- The Network Control programme is engaging with IT infrastructure teams on hardware and architecture for the CNI data centre environments that would house the tool. There are some costs pressures due to internal and external factors.
- National Grid Electricity Transmission are building a similar system (because the current system is shared). NGET are in a comparable position and there are ESO-NGET working groups that meet regularly.
- The current system will go out-of-support in November 2022 and will be extended to ensure continued safe operation until the new product is ready. A backlog of tactical and security improvements has been created and will be delivered.
- Challenges include siloed working with the Balancing Programme and DSOs.

6. Product model update

- Norma Dove-Edwin (chief information officer) presented an update on the product model and ways of working initiative.
- A survey was run to ask colleagues about the strengths and challenges of our current culture and behaviour. One of the top challenges was siloed working and effective collaboration across teams.
- As part of the digital mindset pillar, the ESO will put customers (internal and external) first and co-create with them.

Q&A and discussion

- Mindset changes take a long term but there are benefits. A customer-centric approach is key.
- To remain innovative and agile, compelling leadership principles is key. They should be visible for everyone to see all the time and become part of the daily fabric of working.
- Define ways of working tenets about how you will work as a team and with other teams.

- Product teams need to start with customer requirements and work backwards. They should be part of creating the narrative and commentary on the outcome to help them feel accountable for delivering it.
- Look at colleagues in their early and mid-careers and create networking events and collegiate knowledge sharing.
  - The ESO is looking to create community of practice to get people from different teams working together and solving problems.
- For transformation projects to land, everyone must be involved. This includes defining management principles. Use modern technology to aid this.
- To avoid siloed working, make sure there is a closed loop between all aspects of the product, including the product manager, the prioritisation of features, the development and testing. That way everyone can see how everyone's work affects each other.
- Control room users will be interfacing with the tools that both the Balancing and Network Control programmes develop so there should be joint user stories.
- There is a need to educate customers to become better customers. Some may not realise they are customers and may not realise they will suffer if new tools or features are not delivered. Encourage customers to focus on outcomes and challenges rather than solutions.

7. Discussion on Balancing and Network Control roadmaps

Product model "factory"

- One of the challenges the ESO is facing is moving the back-end process like funding and governance to an agile way of working. Some of the product teams are funded as a stand-alone capability but it can lead to difficult conversations with sponsors when roadmaps are not clear.
- Use terminology that teams understand and are familiar with, especially when talking with the operational colleagues. Bring them along with you and recognise that they are from a different working environment.
- A part of a one-team approach, all the resources needed to deliver need to be considered from the start and defined.
- Visualisation is important to get around language issues and help people share information in a simple and digestible way. Don't wait until something has gone wrong but track process in visual way.
- There will be an opportunity to discuss with Ofgem changes to our funding model as part of the next price control.

Consideration of carbon in energy balancing

- With the ambition for net-zero operation ability by 2025 and a fully decarbonised energy sector by 2035, is a there a need to make available information on fuel type?
- A challenge is with optimisers. So that new services can be onboarded quickly, we do not want to have to keep updating the optimiser with new service, fuel and unit types. The back-end systems can still know what was dispatched, what fuel type it was and report this transparency to the market.
- The flexibility built into the new OBP may allow for a change in priority from price to carbon considerations.
- There would be a need to distinguish carbon from fuel type because the carbon emission would actually be what you are concerned about.
- There are also challenges around the ESO's current licence obligations where the ESO has to dispatch in economic order.
- There are some carbon considerations coming along, for example with the Clean Energy Package that TSO's can only constrain a certain proportion of wind. So, there may be a need to consider carbon considerations in optimisation.
- The BEIS carbon price gets considered in the RIIO-2 cost-benefit analyses. One of the benefit areas is reduced carbon emissions because we better tools the ESO will be able to ensure it can

handle a world of lots of small, decentralised renewable generators. Without investment in systems, it cannot use that low carbon generation, which increases emissions.

- Full reporting is need. Consumers and governments should know the carbon emissions of generation.
- Carbon is not the only consideration. Also need to consider other sources of emissions like NOx. NOx is a local pollutant from diesel engines, which tend to sit close to local populations.
- One of the challenges with Power Available was to establish consistent, granular (technology, fuel-type) external reporting over time to benefit the development of balancing services.

Transition between current and new systems

- To aid transition, an option is to develop simple modules around the outside of the module being built that can be run in real-time or faster than real-time for testing. The modules don't need to be thrown away – they can be built into a "library" of simulators which can be used by others.
- The ESO control room trust the current system because it's very established. Users can have a very strong connection to the units being dispatched. The first new capability to be delivered will be bulk dispatch and there will be a challenge to get users to trust and adopt the new system.
- Having parallel runs and allowing users to see outcomes can help with this.
- A "personal" connection between the control room user and the unit being instructed can causes issues with having greater automation because they are difficult to factor in and account for.
- We have found that there are some unwritten rules in operators heads instead of within the market frameworks. For example, not moving a large thermal unit for a small increase or decrease in energy or a short amount of time. We are now having to go to working groups to discuss what this means for industry and consider how we approach this to ensure they can be accounted for.
- A challenge with network optimisation can be that the recommend solution is to change everything a little bit. Global constraints on the number of actions are difficult for automated optimisers to account for.
- Another example is the minimum zero and non-zero times of units. This can lead to units not being dispatched because they are being held for a later time.
- These considerations should be written down and published to ensure a level playing field. It is also important for directing providers towards planning beyond the gate, so they can consider the challenges that the control room face. This would help providers invest in the right areas and help the whole market. Current industry working groups, for example Issue 98 which is looking at dynamic parameters, would be interested in these.
- A consideration around implementing some of these changes, for example, flexible dynamic parameters is that it will be expensive and difficult to implement them into the legacy systems. We need to consider how we can most efficiently deliver these changes until the new systems are ready.
- A start would be writing down the rules – it can be done outside of code changes. A number of new providers would not be able to accept changes not being made in legacy system because they need to demonstrate a return to their investors.
- There is a need to make sure that unwritten rules are still valid, given the scale of change in the energy landscape. It may still be the right answer, but in some areas it may also not be. Documenting the unwritten rules can help with this.
- There may be an opportunity to use machine learning (ML) to learn the control room nuances with a view to implementing a level of automation in the future. This is something that the ESO is looking at in collaboration with academia, but it still represents a challenge because there are a lot of binary decisions whereas ML works better with continuous variables.

Siloed working

- Avoiding siloed working can be achieved by common data, common architecture, common technology and common user stories.

- There is a need to consider not only the needs of the control room users that the tools are being built for but also the users of the whole system. The market participants will need to interface with both the Balancing and Network Control tools. This would lead to a user story or dataflow that spans both, leading to shared features than span both product teams.
- Linked to this, the ESO is building a data platform to allow participants to see the data they need in near real-time. At the moment the data we send and receive is largely spot fixed.
- We are aiming for the control room user to have a single user interface where they can put screens together and combine network and balancing data.
- A challenge the ESO faces is around architecture. The architecture we build into the data centres has to be separate and different in order to fulfil CNI requirements. Redundancy and resilience are important – there cannot be single point of failure or a single type fault.

Resiliency and energy security

- The 2021 Texas power crisis was an example of a system that was highly reliable, highly flexible but not resilient. Weather proofing had not been installed and the capacity market was designed around summer peaks, not winter issues. There is a need for the system to be able to come back online after an unexpected event and so you need to consider what do you would need to do for it.
- A related challenge is “modelling what you can model” issues. Events that get modelled tend to be those that are easy to model or where there is historic data. Historic data can quickly become out of date.
- There is a link to the visibility of fuel types discussion – they all have different capabilities which may make some better than others for resilience. There is a need to solve for the resilience, reliability and flexibility and bring them together.
- A lot of capacity markets procure capacity just by looking at the delivery year (often four years of the auction), meaning that the unit is also going to be participating in balancing markets.
- An issue with a technology blind set-up is that it does not consider the benefits of technology diversity.
- The ESO takes resilience extremely seriously. But we need to remember that resilience incurs cost, so there is an amount of risk that we need to take into account. It might be useful for there to be a cross-industry risk profile so there is a common understanding of what is acceptable.

Asset health

- The bulk dispatch project seems to have been ongoing for a long time. Sometimes to move on and do the big projects in the future there is a need to complete projects.
- There is currently a form of bulk dispatch in the control room. It is limited in the fuel types it supports and it has been used to try and facilitate the increase number of small BMUs. There are challenges with the tool, but these are being address as part of the asset health work in incremental improvements.
- The overall aim is to get to a bulk dispatch tool that works across the entire balancing mechanism, but this will be unlikely in the current estate.
- There is a balance to be struck: continuing to upgrade legacy tools can divert resource away from building the new tools. The current costs of the balancing the system and the need to honour promises and ensure market confidence mean that investment in legacy systems is important.
- Need to remember that the ESO operates a live system that needs to be one all the time.
- The ESO has world class levels of reliability that customers and consumers expect, so asset health investment is important. We currently have at least two more years of asset health investment planned. The investment we forecast for this at the RIIO-2 was too low.

DSO-TSO consideration in system operation

- The ESO is going from a place of interacting directly with a few hundred large entities to interacting with 20-30 million entities at different voltage levels. To make effective use of capacity

there will be a need to coordinate across voltage levels. Current cross-voltage services tend to be distribution connected assets providing transmission network services without considering distribution constraints. There needs to be a principled IT architecture that will give a strong guarantee of a good overall outcome for the system without unduly constraining what individual entities can do. It may need to be distributed or decentralised because otherwise the computation will not work, even if you could write down the centralised problem.

- A key consideration of a common framework is primacy rules. The Open Networks project is looking at these. However, that is focuses on the rules and governance rather than the IT architecture itself.
- The ESO has been talking to DNOs as part of the stakeholder engagement for the Network Control programme. Like the ESO, they appear focussed on foundational change, like getting their SCADA systems into a position where it could do the next level of technology, rather than how we join together. There is a need to go faster on joined-up thinking.

Market reform

- There is a need to consider whether market reform will change the role of the ESO, and therefore necessitate different systems than we might currently be developing.
- Drivers for market reform, such as locational marginal pricing (LMP), include:
  - Increased constraint costs
  - International examples like Germany where there is a strong push away from market redispatch to a locational model. Brexit present an opportunity for change.
  - The views of think tanks who are pushing this as the best way to site generation and demand.
- With locational marginal pricing, there will be a lot more interaction from the ESO required in the wholesale market to get the locational price in the nodes correct. However, there will still be a need for a residual balancer, but it may be reduced as constraints would be solved in the wholesale rather than balancing markets.
- There will be residual requirements in the balancing markets different to constraints, like frequency response. A lot of other markets will not be factored into the LMP price.
- Wherever the single price node is defined there will still be congestion under that node that needs to be solved, whether by the ESO or a DSO market. Functionality will still be required but potentially at different times and places.
- The thoughts are consistent with the ESO's current thinking, especially in dispatch timescales. There may be enhancements in capability needed in scheduling timescales, for example calculation of prices. New systems will also be an enabler of market reform, because it will be difficult to do them in legacy systems.
- A number of other systems like registration and pre-qualification will also need to change and there may be more of a challenge with these.

Market design

- An example of a challenge with the current market design is with bid-offer acceptance (BOA) instruction. The design of BOAs makes optimisation and automation challenging.
- One of the new modules within the new balancing capability will be called Instructor. We are trying to bake in flexibility around the type of instruction that it can handle, including open and closed instructions, AGC and open-ended instructions like frequency response mode.

Transparency

- Transparency is very important. Market participants need to know when to expect new services.
- One of the rest ways to get IT right is to encourage churn between control, trading and IT. Could doubling the number of people in the ENCC help solve issues now and then also get involved with the detailed design specification of the new capabilities been delivered.
- We are trying to find ways to get the control room customers involved in our technology decisions.

- There is a need to frame the investment in terms of the size of the market. It is not surprising the initial cost estimate is no longer appropriate. The aim is now to arrive at a stable programme plan and report transparently against it.
- The ESO does have robust governance in place. One of the challenges the programmes have been set is to be transparent and engaging about how we are doing with our plans and the costs.
- There are a number of different assurance routes. It can be a third-party review of the programme or an internal audit function. Some companies have an investment programme review function that conducts an independent check at every major gateway.
- Ultimately, the ESO will need to assure Ofgem and give them confidence in the current price environment that the plans are robust, and checks and balances are in place, to allow them to sanction investment.

8. Subgroups

- There have been two meetings of the *Control Room of the Future* subgroup. The first meeting was about vision, non-functional requirements and architecture. The second meeting was about data.

9. Next meeting

- 10 June, 09:00 – 12:30.

10. AOB

- Norma announced that this will be her last TAC meeting as she is leaving the ESO. Norma thanked all members for their contributions.