# **Final report: CESI FFC1-002 Control Rooms of the Future.**

## Project overview

Integrating energy infrastructures could have significant implications for operations in the energy system. Despite many years of adherence to political arguments around market provision and competition as the main driver of energy development, much of the UK’s energy transmission and distribution infrastructure is still tied into monopoly systems of control. **Control Rooms of the Future** took a first foray into what integration might mean in relation to system operation by conducting pilot research into control systems for distribution of gas and electricity.

The project had two approaches that address regulatory and institutional, as well as operational questions. First, what are the regulatory and institutional conditions under which different energy vectors (gas and electricity) operate, and how might they facilitate or restrict the opportunities for more integrated operations? Second, what are the operational practices in different kinds of control rooms, and what opportunities do they afford for cross-vector co-ordination, and what risks do they present in terms of translating one control room culture to another? The project therefore included a review of relevant regulatory conditions, alongside empirical research based in distribution control rooms in the respective sectors.

The project was conducted in close collaboration with work led by Haris Patsios with Hamid Hosseini and Adib Allaham who developed a modelling exercise to apply techno-economic-environmental evaluation framework for analysis of integrated gas and electricity distribution networks.

In parallel, Abram and Silvast followed two empirical case studies to document routine control room practices and explore how further integration might impact electricity and gas distribution control room operations, and what flexibility they might have to operate integrated gas/electricity systems. During 2019, Andrew Wright prepared a briefing document on the regulatory challenges for sector integration at this level. Antti Silvast and Simone Abram then conducted observations in three control room locations, two gas control rooms and one electricity control room, with the cooperation of Northern Gas Grids and Northern Power Networks. 18 interviews were conducted during the empirical research. Additionally, meetings were held at InTEGrel including representatives from NPG and NGN, and with members of the project team plus Phil Taylor. A workshop was held in 2020 to share the findings with the project participants.

## Summary of findings

The modelling exercise showed that there are clear benefits to be gained by integrating electrical and gas networks according to the scenarios evaluated. Assumptions and methodologies used in the modelling exercise do need to be further examined, however, and a range of other scenarios could be explored. In particular, assessing the potential for integration at other sites or where more significant renewable assets are being installed could give a much clearer idea of the potential for this form of integration. Broader, and deeper scenarios could be addressed, and critical scenarios could be estimate that outline at which scale renewable curtailment, hydrogen production, or gas integration the system starts to offer significant advantages. In other words, fuller planning and operational models could be developed to develop the scenarios.

In regulatory terms, a more detailed examination of codes and regulations would give a clearer outline of where attention must be focused on adapting the regulatory framework to enable further integration. A full risk assessment should also be developed to analyse the potential weaknesses that integration may entail – particularly in relation to system-wide failures or attacks. A more detailed regulatory review would help to outline where points of concern are to be found, such that these could be effectively addressed.

In terms of control room operation, it was notable that neither the gas nor electricity shift engineers had been in the corresponding control room on the other network. A useful empirical exercise would consist of asking shift engineers or shift managers to observe a shift in one another’s network, using observation and interviews to help outline the key areas where they experience differences that could impact on communications between networks. Difficulties with larger scale change, and particularly in the case of system integration, are often most keenly anticipated by those who operate on the ‘front-line’.

Further attention should be given to the role of transmission in integration. Currently, in relation to the NE, large scale renewable resources come under the remit of the National Grid transmission system, meaning that decisions on curtailment are taken above the distribution level. However, in some other distribution networks, active network management is more of a concern. Further research should include existing ANM operations in the UK, and potentially consider international comparative cases.

## Outputs

The following outputs were completed:

* A case study summary
* A working paper combining findings from the three approaches identified.
* A draft paper by Dr Andrew Wright on the institutional context of control room integration.
* A peer-reviewed journal article in Energy Histories on flexibility in the energy system: Simone Abram, Antti Silvast, “Flexibility of real-time energy distribution: the changing practices of energy control rooms”, *Journal of Energy History/Revue d’Histoire de l’Énergie* [Online], n°5, published 14 April 2021, consulted 14 April 2021, URL: energyhistory.eu/ en/node/254.
* A journal article submitted for peer review with the journal Computer-Supported Cooperative Work (currently undergoing revisions: Habits as mediators: remarks on control room practices and their connections. (A Short Paper Offered For The Special Issue “Moving Back to the Control Room - Revisiting Centres of Coordination”)

The project was completed to budget.