Power Network: 23 years till net zero. Can our networks achieve it?

Keith Bell

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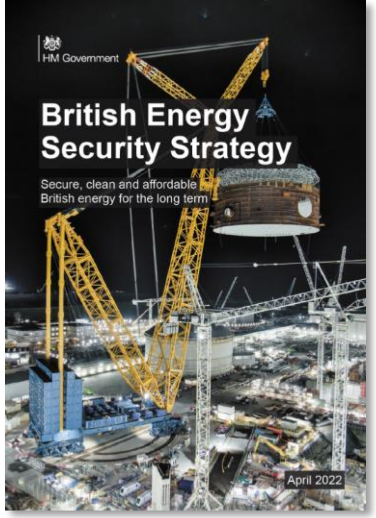
http://www.strath.ac.uk/staff/bellkeithprof/

All Energy, May 12th 2022

April 2022 “Energy Security Strategy”

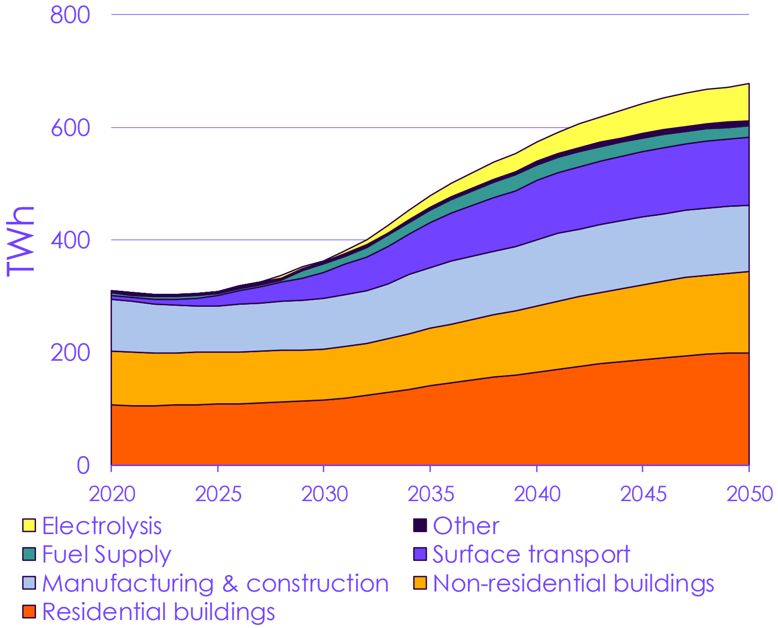


	Nuclear	Offshore wind	Onshore wind	Solar	Total
Capacity (GW)	25	50	30	70	
Target date	2050	2030	Not promised	2035	
Capacity factor	90%	55%	30%	12%	
Annual energy if fully utilised (TWh)	198	241	79	73	590

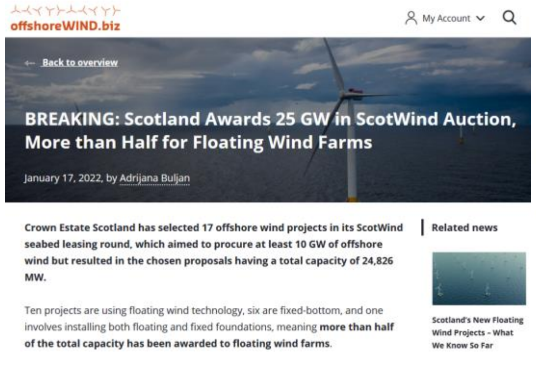
- Reduce dependency on fossil fuels
    - Short term: reduce vulnerability to global gas markets
    - Medium to long term: leave (almost all?) fossil fuels in the ground
- However, little to say on
    - energy efficiency
    - the residual demand curve challenge
- To me, 3 things are important:
    - being as efficient as possible in our use of energy.
    - being able to make full use of low carbon electricity when it’s available.
    - still meeting demand when it’s not windy (and when it’s too windy)

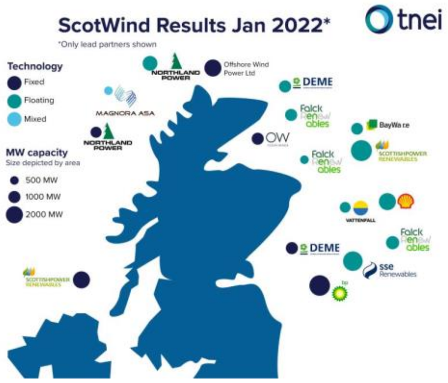
all at least cost

Demand for electricity in the CCC’s Balanced Pathway



How much transmission network capacity do we need?





Peak Scotland-England flows could be as high as 14 GW with connection of 10 GW of new wind

- Export capability today ~6.5 GW
- With 4 × 1.4 GW HVDC links, capability grows to ~12 GW

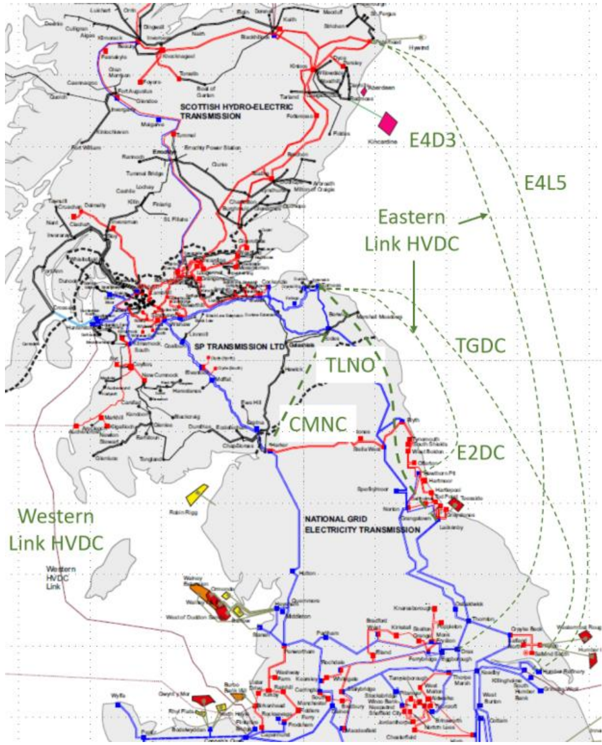
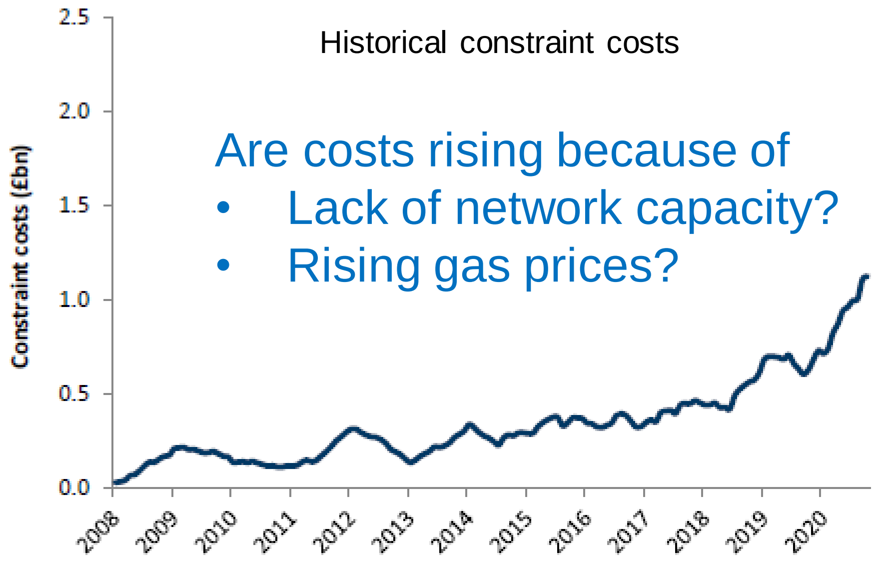


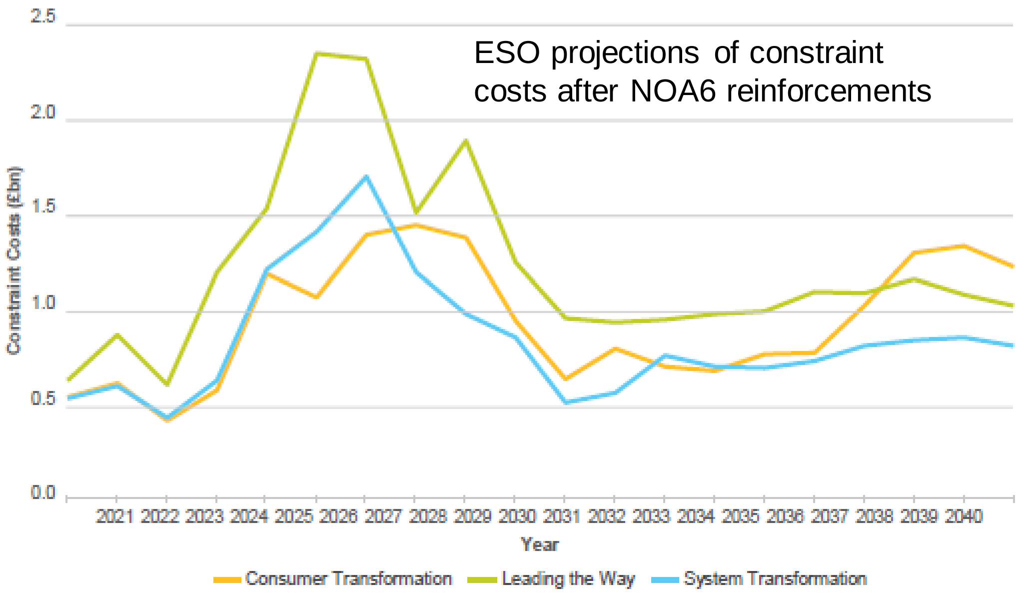
Figure: SP Transmission/NGESO



Are costs rising because of

- Lack of network capacity?
- Rising gas prices?

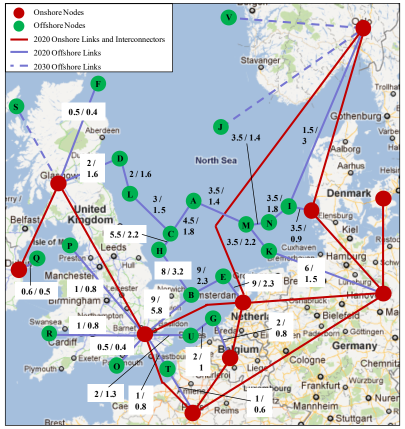
ES MBSS data, presented by FTI, *Operation market design: Dispatch and Location*, January 17th 2022



ESO Net Zero Market Reform report

Co-ordinated system design saves on cost and on environmental footprint

University of Strathclyde Engineering

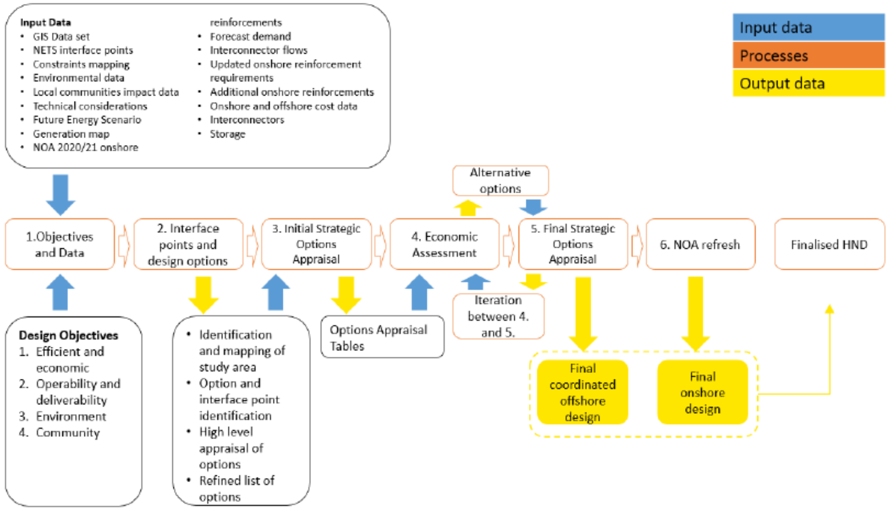


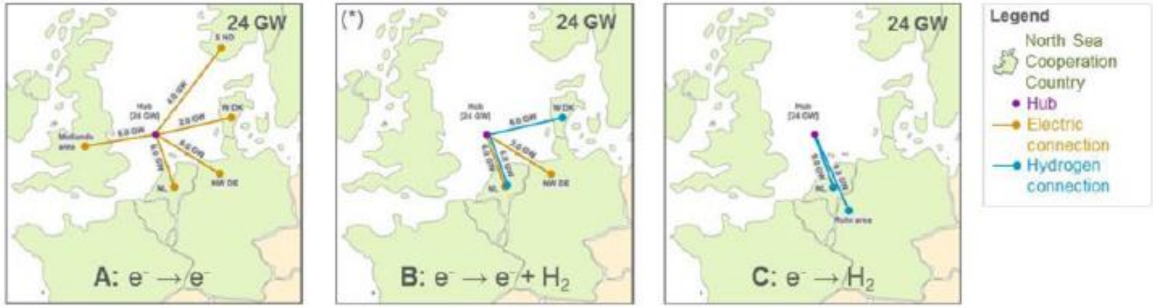
TWENTIES offshore grid study, 2012

Cables being laid for the Nemo interconnector
https://www.nationalgrid.com/stories/grid-at-work/nemo-link-open-business

Nemo converter station, Belgian side
Nemolink.co.uk

Holistic Network Design methodology, NGESO, Feb. 2022



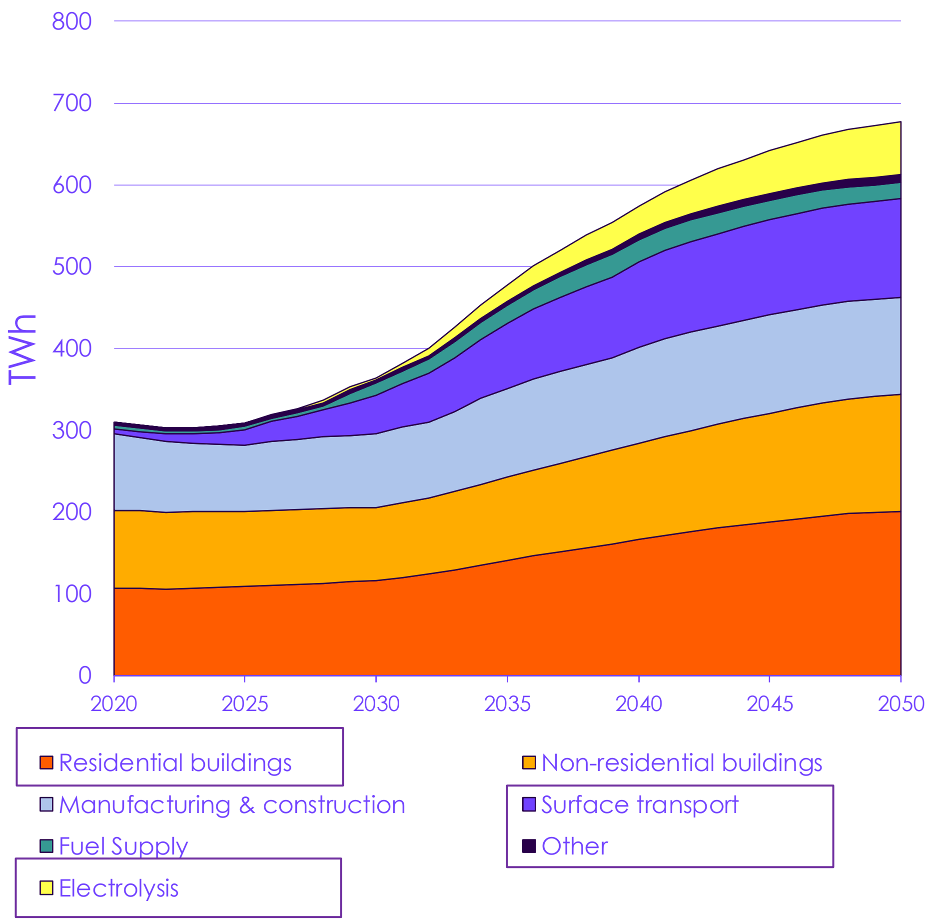


https://northseawindpowerhub.eu

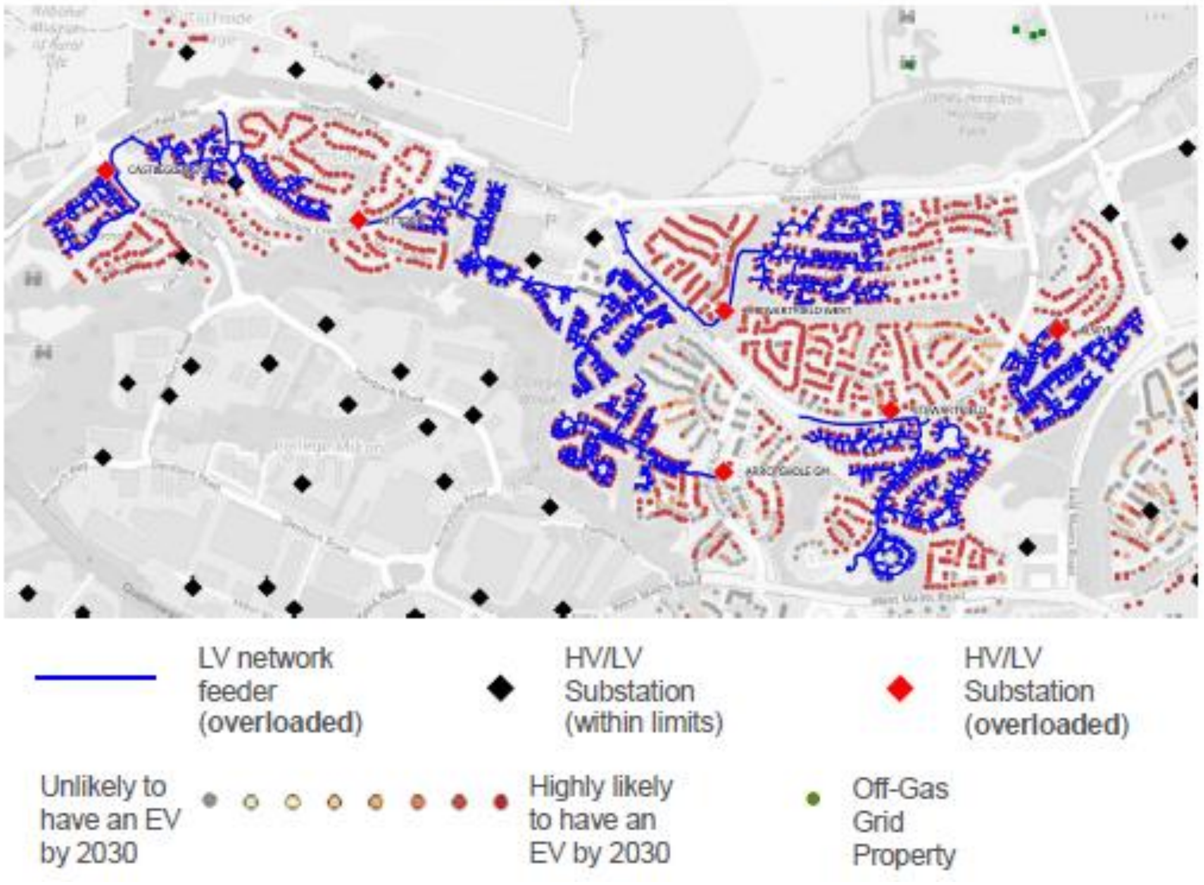
North Sea Wind Power Hub Programme

"Engineering Net Zero"

Demand for electricity in
the CCC's Balanced Pathway



East Kilbride - Constraints and Solutions Case Study



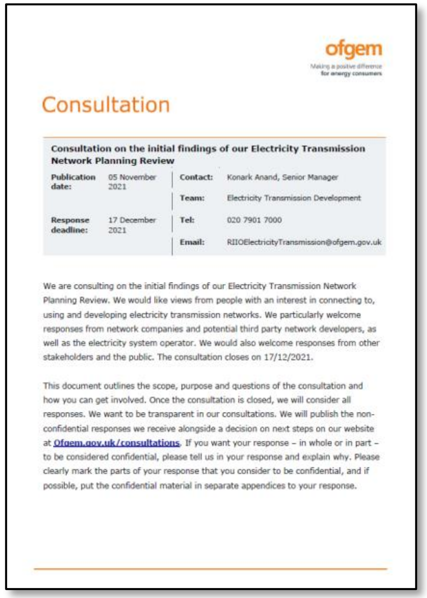
https://www.spenergynetworks.co.uk/pages/our_riio_ed2_business_plan.aspx

Extreme weather and increasing dependence on electricity

Image: Electricity North West
https://www.bbc.co.uk/news/uk-59396135

Image: PA
https://inews.co.uk/news/more-than-19000-homes-still-without-power-six-days-after-storm-arwen-1331091

It’s not the despair; it’s the hope


ofgem

Making a positive difference for energy consumers

Consultation

Consultation on the initial findings of our Electricity Transmission Network Planning Review

Publication date:	05 November 2021	**Contact:**	Konark Anand, Senior Manager
		Team:	Electricity Transmission Development
Response deadline:	17 December 2021	**Tel:**	020 7901 7000
		Email:	RIIOElectricityTransmission@ofgem.gov.uk

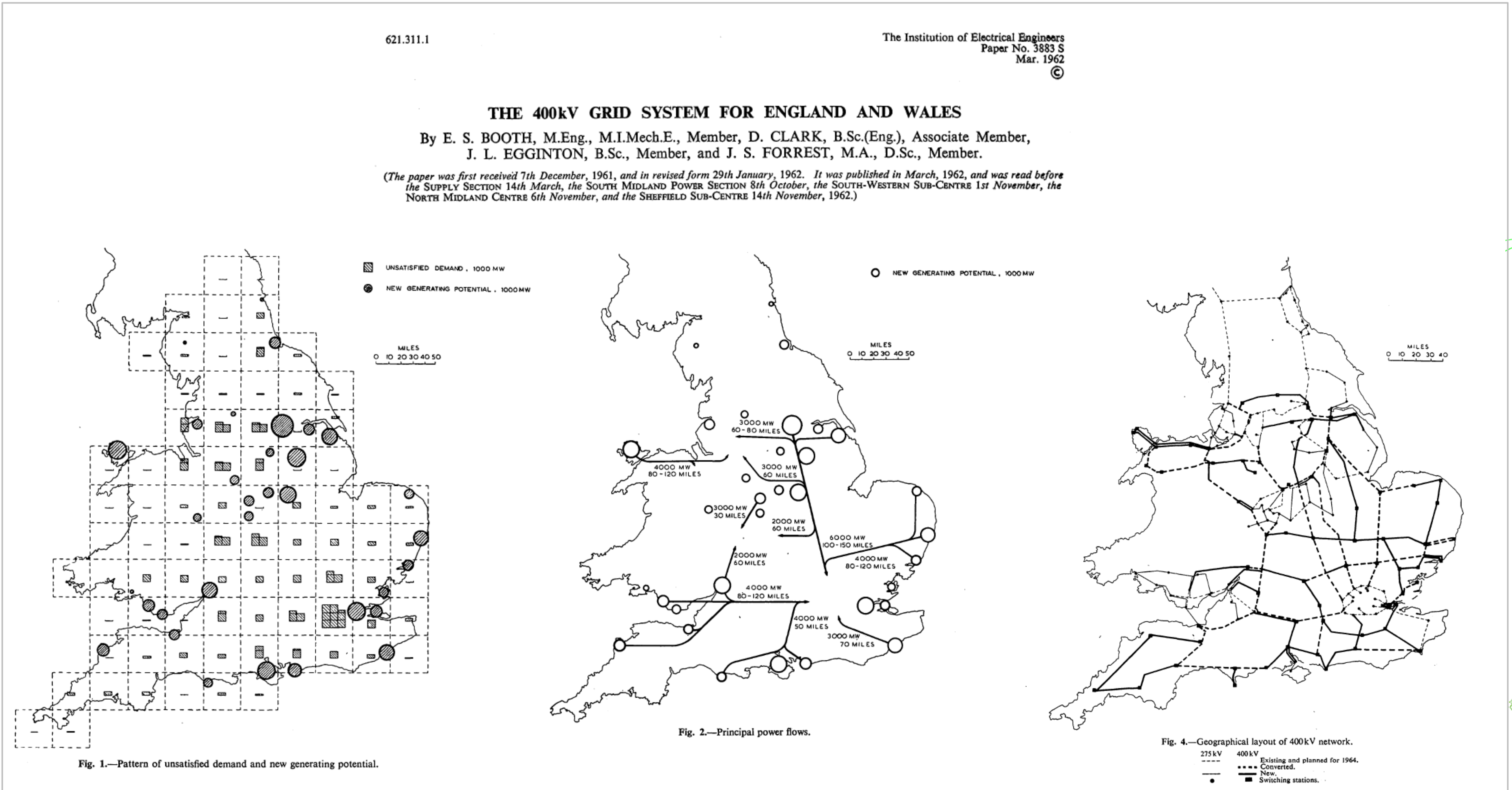
We are consulting on the initial findings of our Electricity Transmission Network Planning Review. We would like views from people with an interest in connecting to, using and developing electricity transmission networks. We particularly welcome responses from network companies and potential third party network developers, as well as the electricity system operator. We would also welcome responses from other stakeholders and the public. The consultation closes on 17/12/2021.

This document outlines the scope, purpose and questions of the consultation and how you can get involved. Once the consultation is closed, we will consider all responses. We want to be transparent in our consultations. We will publish the non-confidential responses we receive alongside a decision on next steps on our website at Ofgem.gov.uk/consultations. If you want your response – in whole or in part – to be considered confidential, please tell us in your response and explain why. Please clearly mark the parts of your response that you consider to be confidential, and if possible, put the confidential material in separate appendices to your response.

“move away from the current broad scenario-based approach used in the FES to a less mechanistic approach that **makes assumptions**, at least for the nearer term future, **that are governed more by strategic thinking**”

a centralised transmission network planning process “could **send clear earlier signals to users of the system** (e.g. offshore wind, hydrogen electrolysis plant etc.) about where and when key parts of the [electricity transmission] network will be built, their high level design, and potential impact on network charges. This could help inform their decisions on siting, capacity etc. and **could enable efficient and timely investment by those users**.”

Think, plan, design, deliver



621.311.1

The Institution of Electrical Engineers
Paper No. 3883 S
Mar. 1962
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THE 400kV GRID SYSTEM FOR ENGLAND AND WALES

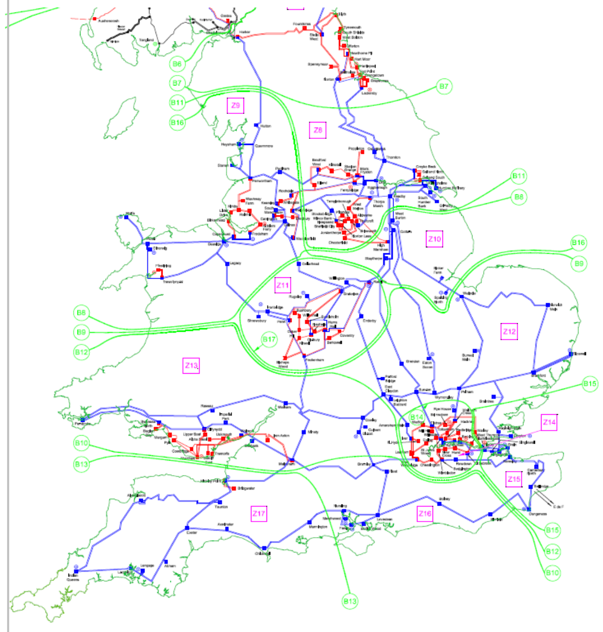
By E. S. BOOTH, M.Eng., M.I.Mech.E., Member, D. CLARK, B.Sc.(Eng.), Associate Member, J. L. EGGINTON, B.Sc., Member, and J. S. FORREST, M.A., D.Sc., Member.

(The paper was first received 7th December, 1961, and in revised form 29th January, 1962. It was published in March, 1962, and was read before the Supply Section *14th March, the* South Midland Power Section *8th October, the* South-Western Sub-Centre *1st November, the* North Midland Centre *6th November, and the* Sheffield Sub-Centre *14th November, 1962.)*

Fig. 1.—Pattern of unsatisfied demand and new generating potential.

Fig. 2.—Principal power flows.

Fig. 4.—Geographical layout of 400kV network.



Designed for

- England and Wales peak demand of 70 GW by 1980
- Midlands to South capability of 6 GW
- First energisation at 400 kV in 1965