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Estimated cost of Great Britain's linepack flexibility per kWh of natural gas

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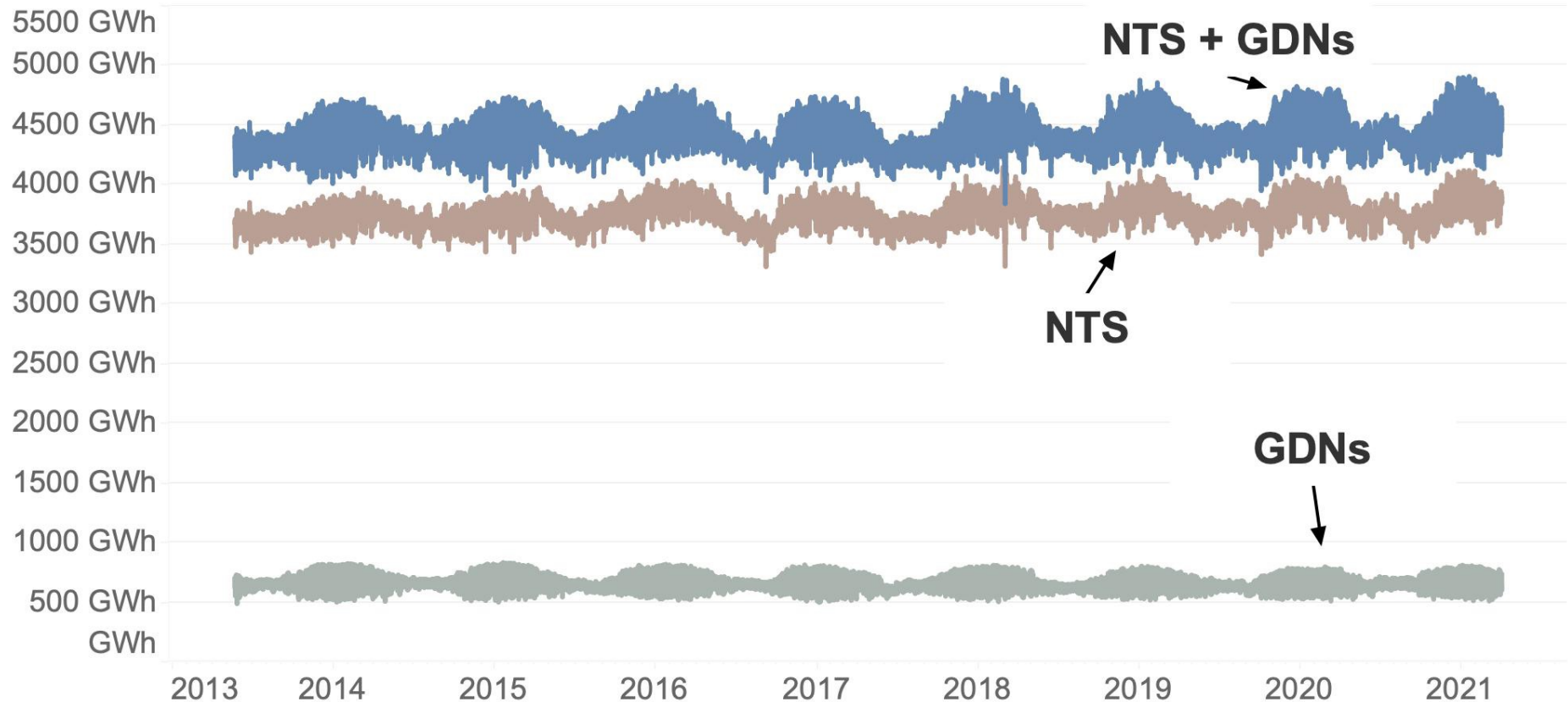
Gas system flexibility

- Flexibility provided by the gas system requires better visibility and discussion around its value. This should happen throughout the RIIO-2 time period
- Currently, there is considerable focus on the electrical system and its ability to provide flexibility over different timeframes
- This presentation will provide values on the historical scale of linepack (only one element of gas system flexibility), and an estimate of the cost to the system, and thus the cost of linepack flexibility per kWh of 'overnight' energy storage



Measured data – from National Grid and GDNs

Energy stored in linepack in NTS + high pressure tiers of GDNs (hourly data)



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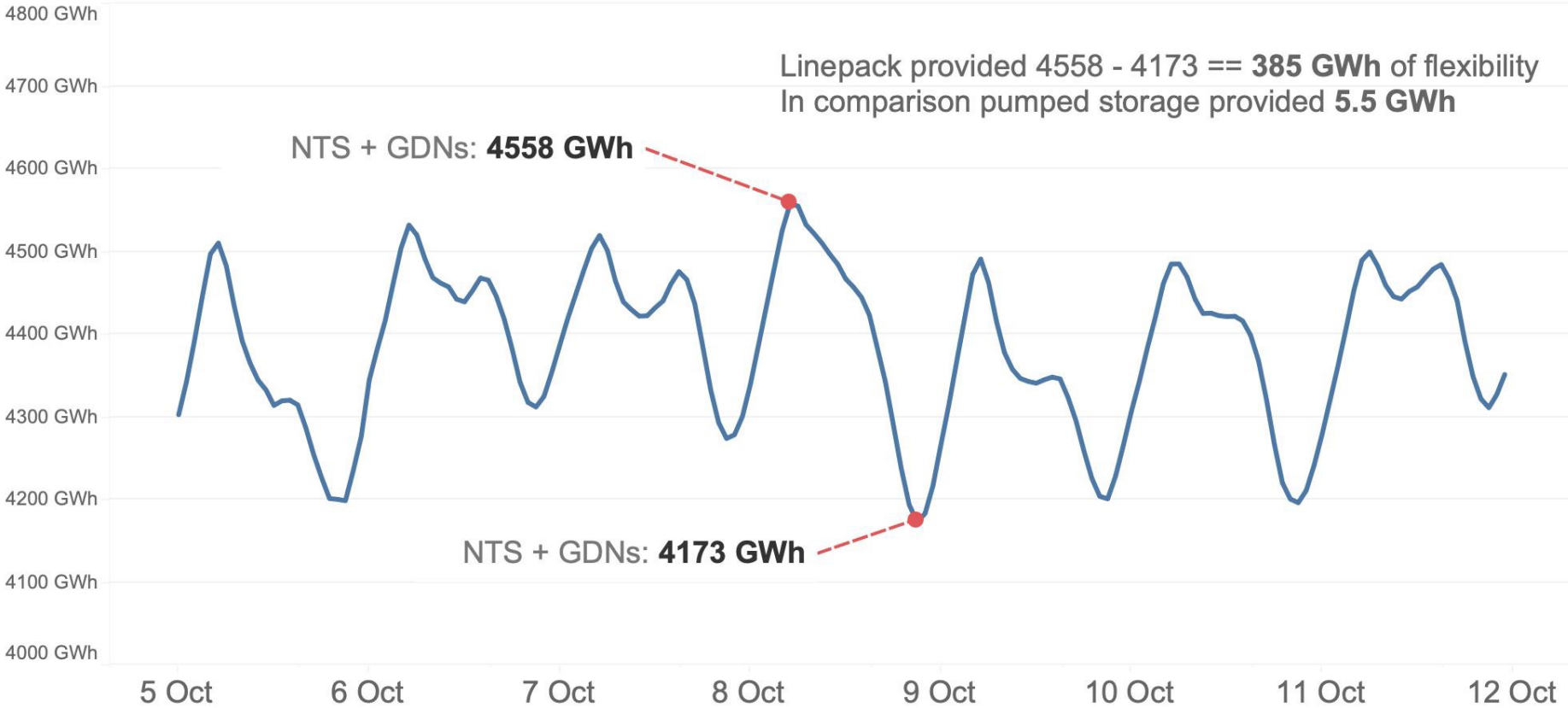


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Measured data – from National Grid and GDNs

Details for a single day to explain linepack flexibility (details shown for 8th of October 2020)



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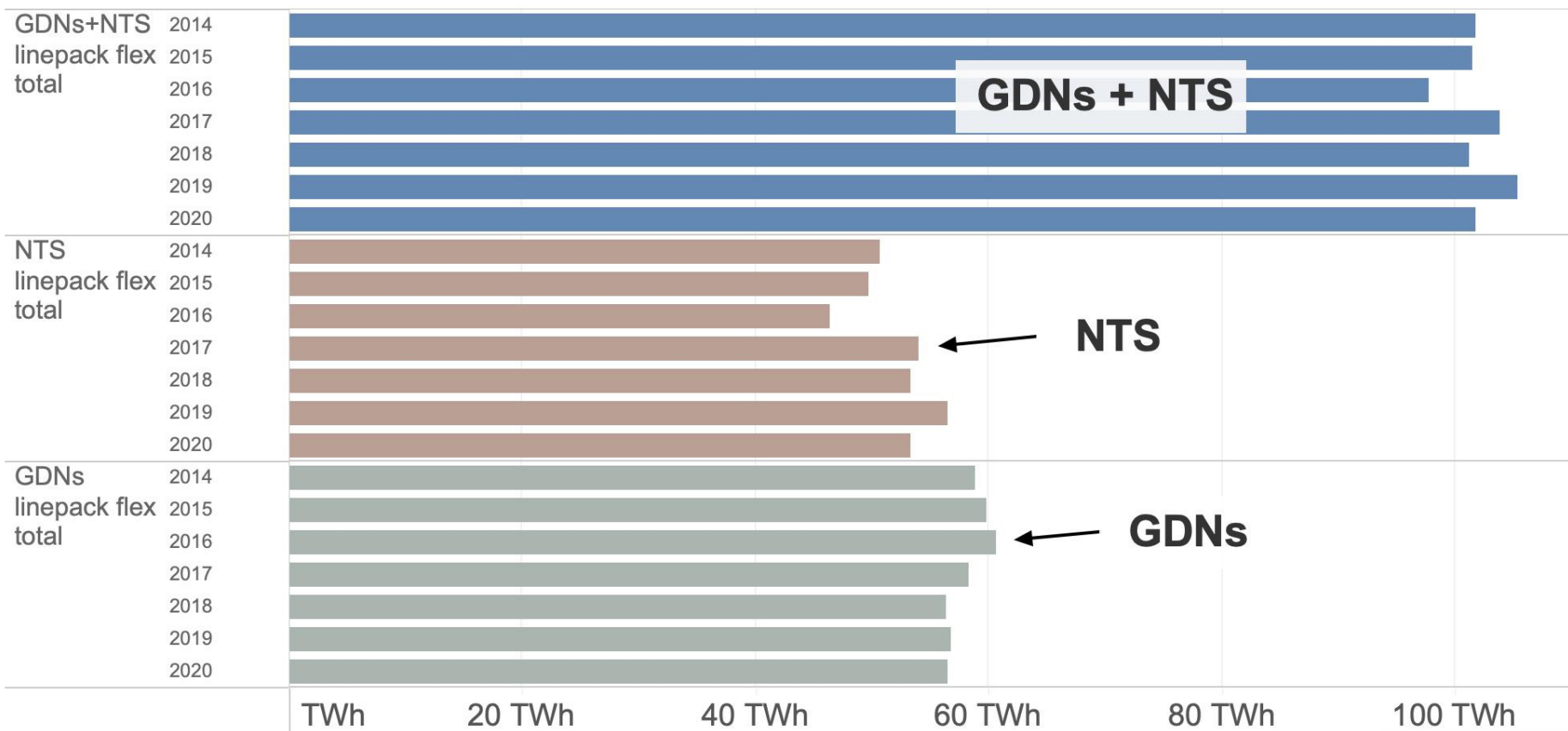
Gas system flexibility

- Adding all of the daily changes in linepack (linepack flexibility) over a year provides a cumulative sum value for the years 2014 to 2020 inclusive
- These cumulative values are displayed on the next slide, with NTS being the National Transmission System values and GDN being the Gas Distribution Network values



Linepack flexibility annual totals (cumulative sum of daily flex)

Linepack flex annual totals



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Cumulative daily linepack flexibility from measured data

- Each year the NTS and GDNs higher pressure tiers typically provide around **100 TWh** of cumulative daily linepack flexibility
- In comparison pumped storage ranged between **4 TWh** in 2009 and under **2 TWh** per year in 2020
- Challenging to disaggregate the costs of linepack and the costs of transporting gas around the NTS system



Estimated costs of linepack provision

- Capex cost estimate is the replacement cost of compressors on the NTS system, say **£30-£40 million** with a lifetime of 25 years
- With 23 compressor stations and 3 compressors per compressor station – say there are 3 replacements each year \sim **£120 million** per year
- Opex costs of compressors estimate using all the gas badged as ‘shrinkage’ at the NTS, say **£60 million** in 2020 (more in 2021)



Estimated costs of linepack storage

- Total is **£120 million + £60 million** per year for compressor capex and opex, and rounding up to **£200 million**
- Regardless of the levels of linepack flexibility (much lower in summer than in the winter), the gas pressures in the NTS are still required to transport gas itself rather than provide flexibility
- In 2020, the NTS transported approximately **900 TWh** of natural gas (including exports)



Estimated costs of linepack storage

- Therefore, a simple cost estimate for linepack flexibility is to use the ratio of **100 TWh** of cumulative daily linepack flexibility to the **900 TWh** of 2020's total gas transported
- Doing so gives a cost of linepack of:
- **£200 million** x 100 / 900 == **£23 million** (rounded up)



Estimated costs of linepack storage

- Using this method of linepack flexibility cost estimation
- **100 TWh** at a cost of **£23 million** equates to **0.023 pence** to store a kWh of natural gas as overnight linepack flexibility
- Even if all of the **£200 million** was allocated to linepack flexibility this would equate to **0.2 pence per kWh**



What does 'overnight' storage at 0.023 pence per kWh mean?

- The costs are uncertain from the perspective of the allocation of costs – but it is clear that linepack provides a very low cost method of storing energy overnight
- Throughout the RII0-2 timeframe, this requires greater focus to understand the costs of storage and make them more visible
- Importantly, can the cost of overnight linepack storage somehow be passed through on a more cost reflective basis?



What does 'overnight' storage at 0.023 pence per kWh mean?

- Shifting demand from the natural gas system to the electrical system can also shift part of the need for overnight flexibility
- There are a number of options for the provision of overnight flexibility to the electrical system including, demand side response, e.g., through time of use tariffs, batteries, pumped storage, and many more types of storage
- However, these forms of overnight storage are likely to cost more than the cost of linepack flexibility, and therefore, this is an area that OfGEM needs to consider with the help of sector stakeholders during the RII0-2 timeframe



RIO-2 discussions

- On a whole system basis, if the gas system can continue to provide very low cost overnight (and seasonal) storage but in future in a low-carbon manner, do regulatory incentives need to change to make this happen?
- Deeper stakeholder discussions should therefore take place through this regulatory timeframe to reduce the risk of appeals to the CMA



Gas system flexibility

- This presentation does not consider seasonal flexibility, or the ability of interconnectors, cavern storage and LNG to explicitly ramp up and down their output to the NTS system
- Balancing energy systems across seasonal and multi-year timeframes seems to continue to require balancing that is orders of magnitude greater than daily storage¹
- Understanding future costs of flexibility is an area that needs further detail for different approaches across the whole system. A better understanding of the levels and costs of existing gas system flexibility can help



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