SMART ENERGY RESEARCH LAB

UNIVERSITY RESEARCH FOR PUBLIC GOOD

Official talk title:

The impact of COVID-19 lockdown restrictions on energy consumption in GB

Dr Ellen Webborn

21st April 2021

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Actual talk:

Why quantifying impact on energy consumption is actually really hard: one researcher's cautionary tale

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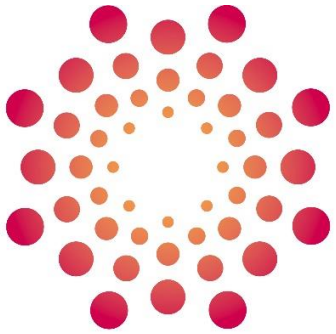
Introducing the Smart Energy Research Lab (SERL)

- £6M 5-year EPSRC project until August 2022
- Consortium of 8 partners led by UCL
- Aim: provide an energy data resource for the UK research community
- High-quality smart meter and linked contextual data for innovative research
- Recruited and collecting this data for 13,000 GB households representative of SMETS2 households (2nd generation smart meters)



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UCL

University of Essex

University of Southampton

Loughborough University

energy saving trust

The University of Edinburgh

Cardiff University / Prifysgol Caerdydd

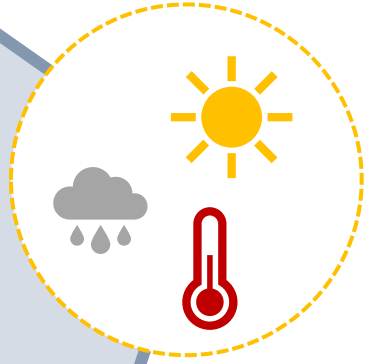
LBU Leeds Beckett University

Gas data

Daily
Half-hourly
All participants with a SMETS2 mains gas meter (~70%)
Up to 12 months before consent, ongoing collection

Electricity data

Daily
Half-hourly
All participants (in theory)
Includes exports if available
Up to 12 months before consent, ongoing collection



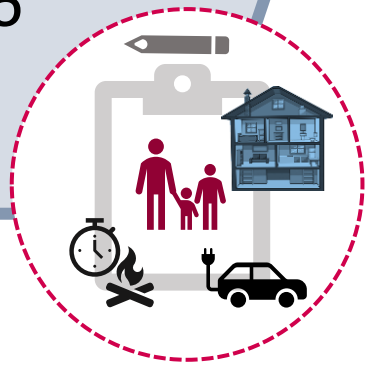
Weather data

ECMWF ERA5 reanalysis data
Publicly available
Hourly, 30km resolution
Initially surface temperature, adding ~20 more variables
Updated quarterly

SERL Observatory Dataset SN 8666

Energy Performance Certificate (EPC)

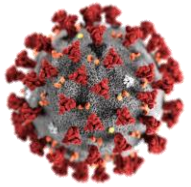
~50% of participants
Sourced externally, publicly available
Updated quarterly/as appropriate



SERL Survey

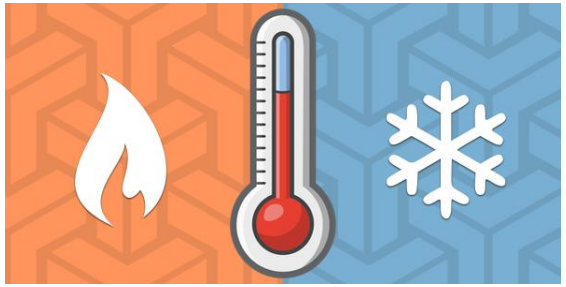
~40 questions on the dwelling, occupants and attitudes/behaviours
~97% of participants partial/complete
One-off collection

COVID-19 research project



- **Aims**: understand how energy consumption changed during lockdown 1 in GB: 24th March – 11th May 2020 (7 weeks)
- All participants recruited in wave 1 (~1700) sent a survey in May 2020 about their circumstances during lockdown (number of occupants, children at home, working remotely, use of appliances…)
- Initial research:
  - Calculate the change in mean daily energy consumption for our participants
  - Using daily electricity and gas readings (in kWh) for participants with both
  - Compare with their energy consumption in a ‘comparable’ 7-week period

Defining our ‘comparable’ 7-week period



- Calculated the number of degree days during 7-week periods in 2019
- Calculated the mean temperature across all locations where our participants are located, for:
  - each 7-week period in 2019
  - the 7-week lockdown period in 2020
- Identified a 7-week period starting in late September with similar average temperatures to lockdown

Initial findings (do not quote)

- Electricity consumption increased by ~10%
- Gas consumption increased by ~40%
- Bigger increases during weekdays compared to weekends

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- Gas consumption increased by ~40%
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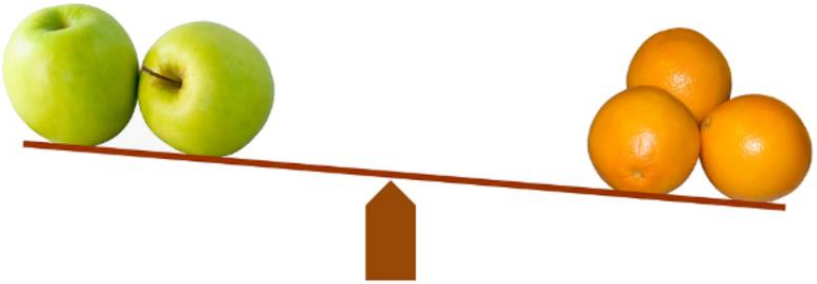
However:

- I used the wrong comparison period, starting 8th September not 27th
- The ‘correct’ comparison period gave completely different results
  - Electricity consumption went up by 2%, down on weekends (reasonable?)
  - *Gas consumption decreased* by 20% on average (?!?!?)

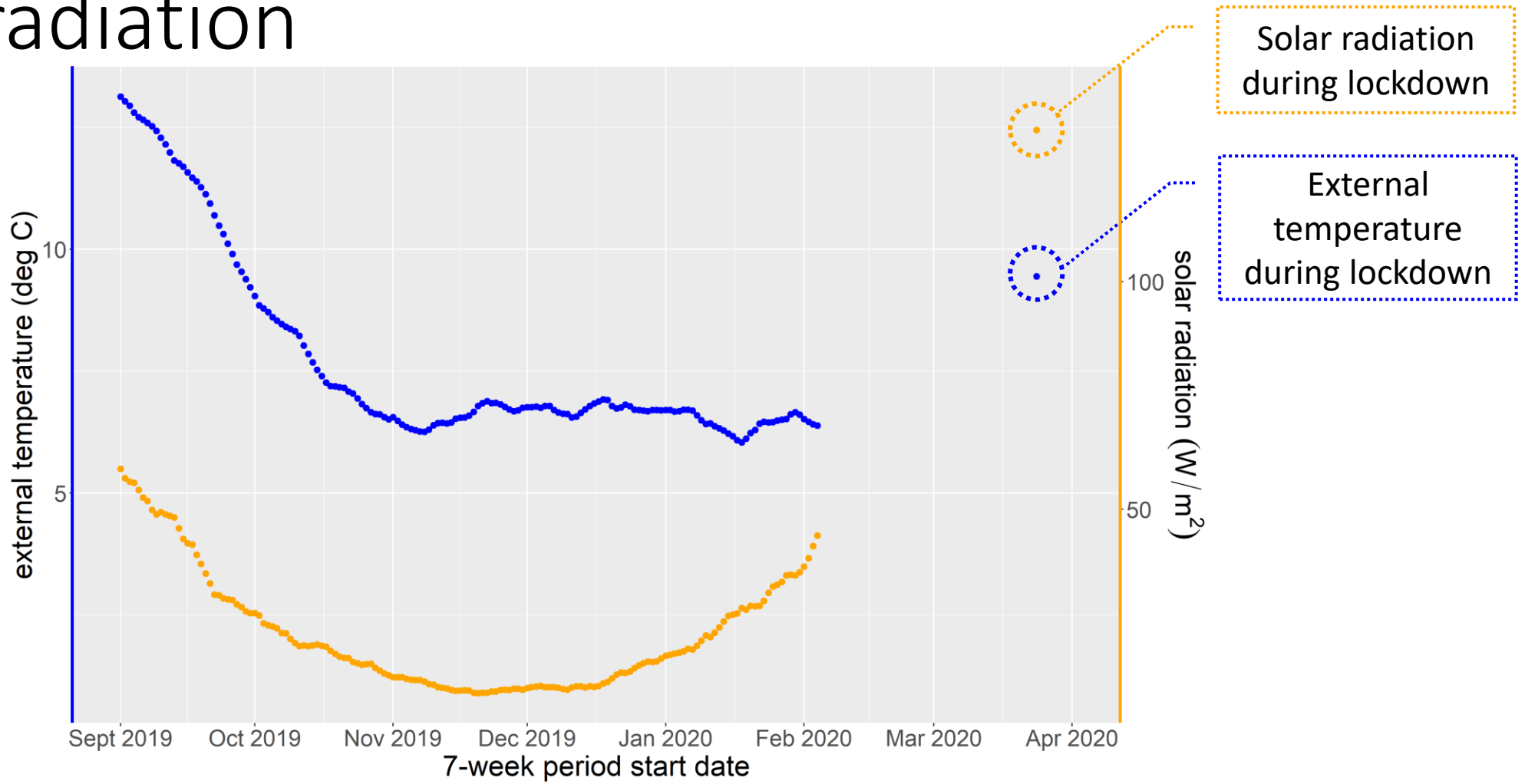
What's going on?



- Clearly the results are very sensitive to the comparable period chosen
- Average temperature isn't the only factor – what about solar radiation?
- Is *27th Sept – 14th Nov* really similar to *24th Mar – 11th May*?

- Decision: investigate this sensitivity
  - 1274 households with no missing data during any period considered (gas & elec)
  - Lockdown energy consumption:
    - mean daily electricity consumption: 9.1 kWh
    - mean daily gas consumption: 31.6 kWh

Comparing mean external temperature and solar radiation



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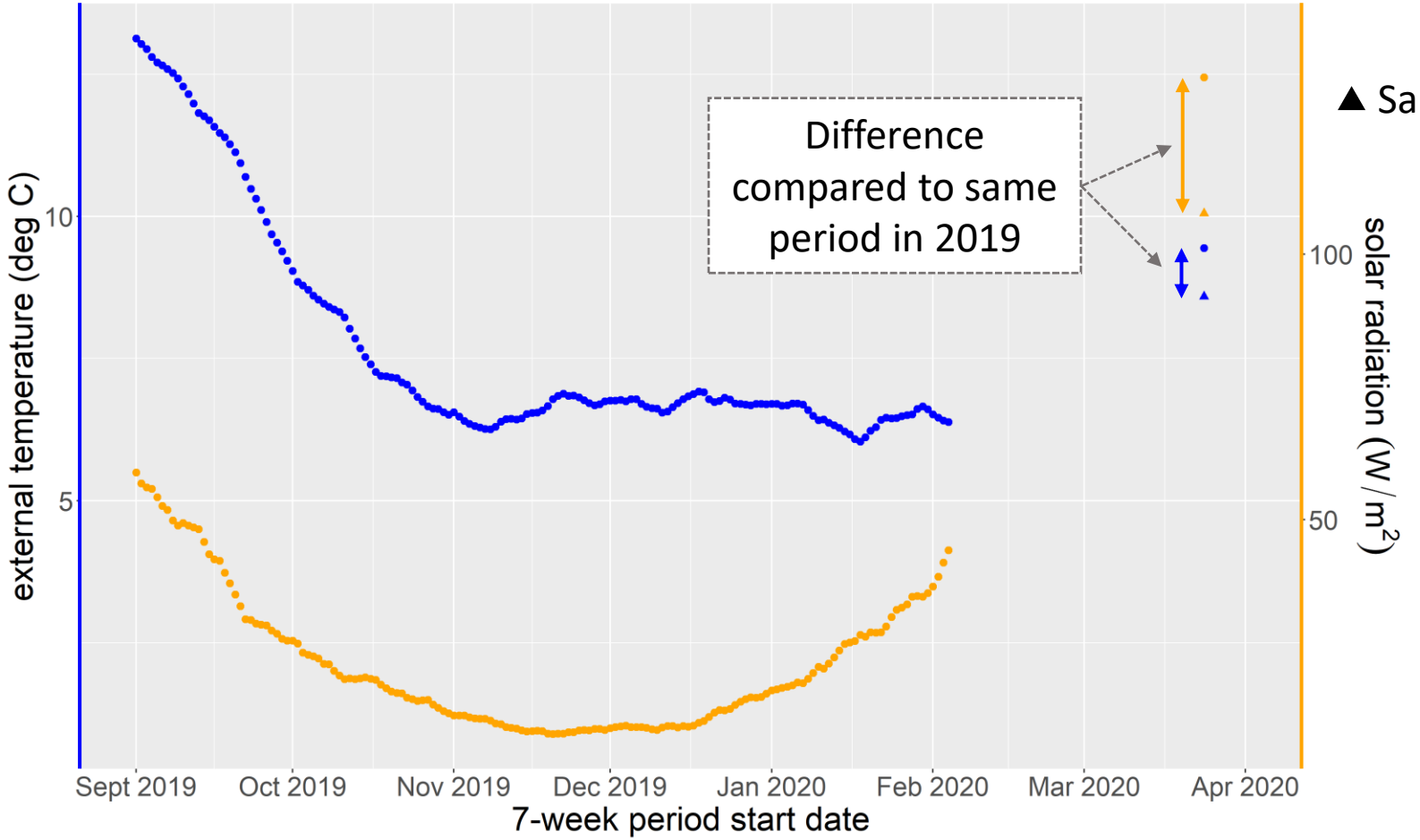
How about the same dates 1 year earlier?



▲ Same date, previous year

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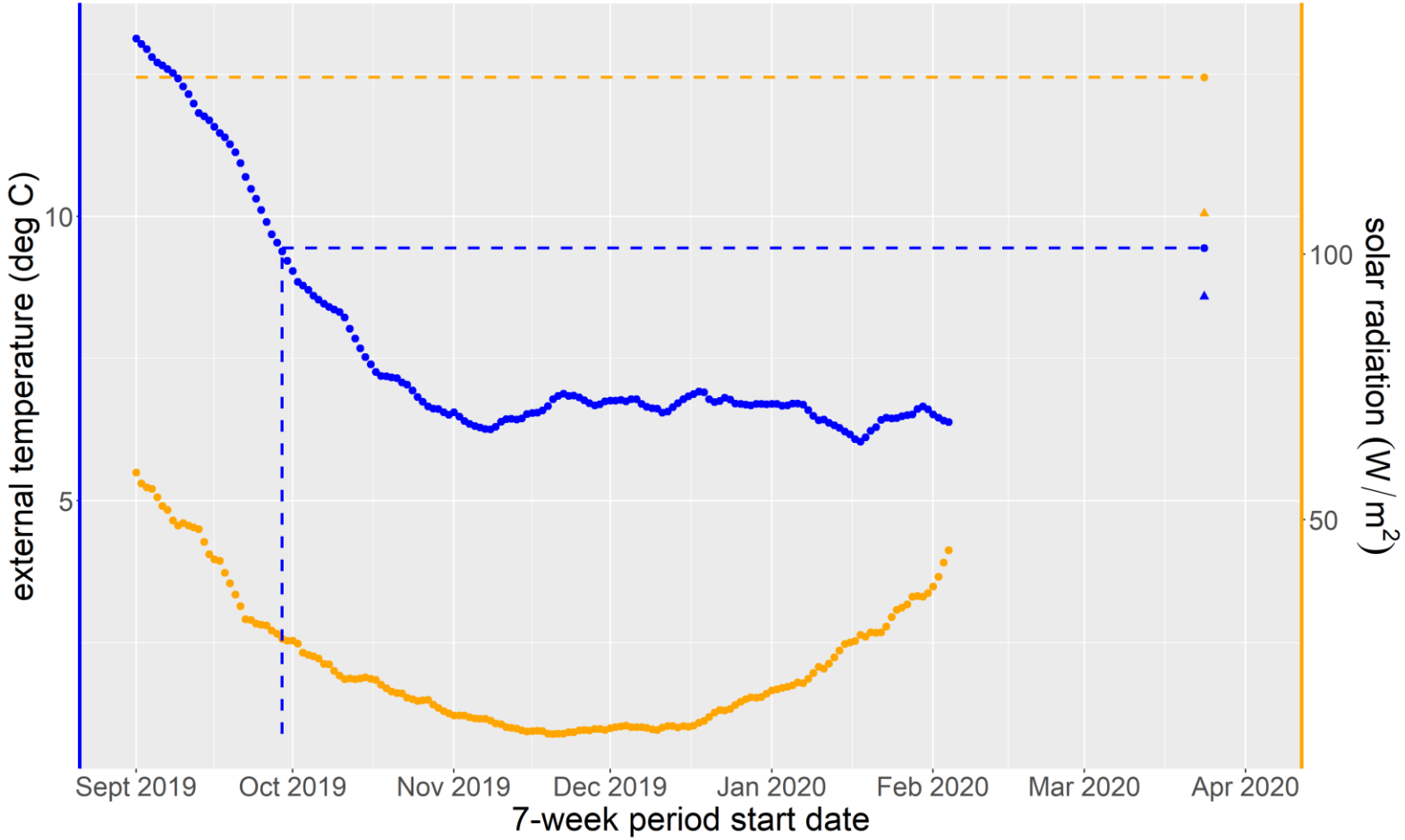
Which dates have similar conditions?



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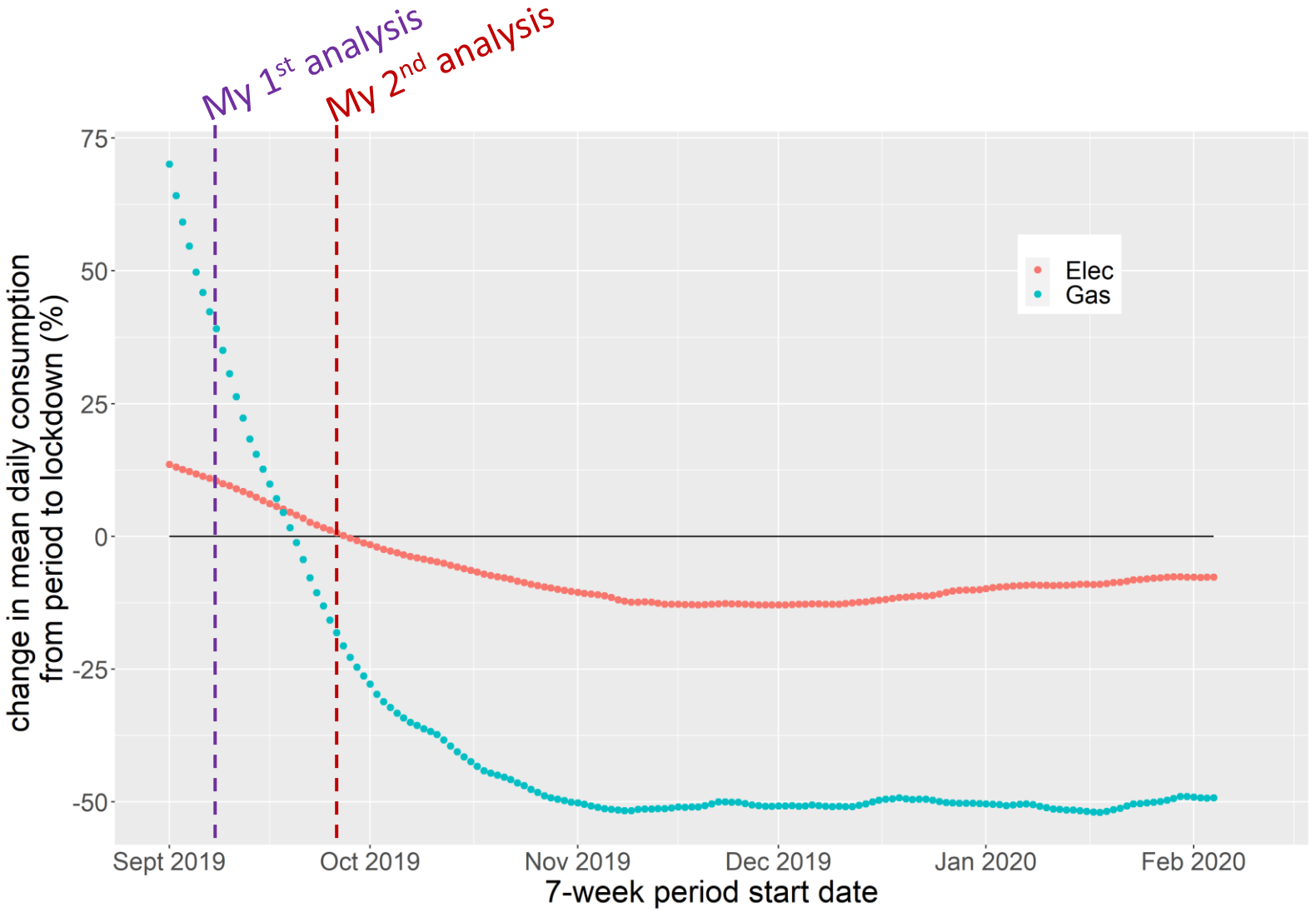
Energy change using different comparison periods



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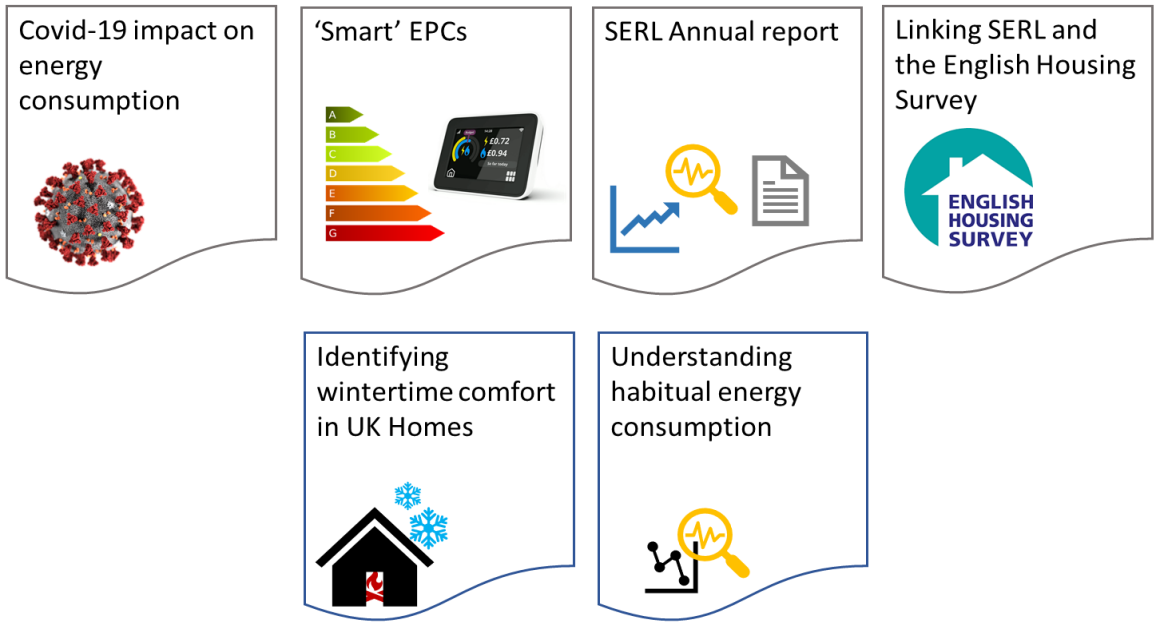
Next steps

- Consumption prediction model based on additional factors, e.g. number of occupants, type/size/age of dwelling, energy performance certificate (EPC)…
  - Compare lockdown consumption with predicted consumption
- Analyse half-hourly data – how did time of use change?
- Cluster analysis – how did different groups experience lockdown energy changes differently? E.g. children at home, financial difficulty, remote working, retired residents, outdoor space…

Acknowledgements

Frances Hollick
Gesche Huebner
Tadj Oreszczyn
Jessica Few
Eoghan McKenna
Kenan Direk
Simon Elam

Smart Energy Research Lab (SERL)



SERL Research Portal - fully operational

- **SERL Observatory Panel**: ~13k representative sample of GB households with linked contextual data
- **Smart meter data**: longitudinal half-hourly data collection from August 2018 onwards
- **Data Governance**: fully compliant with GDPR, Smart Energy Code and research ethics
- **Secure Lab environment:** hosted at UK Data Archive

SERL Research Programme - underway

- **Innovative energy demand research**:
  - 8 projects commissioned and in progress
- **Programme Evaluation**:
  - BEIS Smart Energy Savings (SENS) trials
- **External Research Projects:**
  - Applications to utilise SERL data are encouraged
  - More info - https://serl.ac.uk/researchers/