Smart Energy Research Lab (SERL) webinar
Welcome & housekeeping

• Please note that the webinar is being recorded
• Attendees video/microphones and chat function are off
• Please use Q&A for questions – you can like existing Qs to upvote if similar to what you want to ask
• We will answer questions as we go along and at the end
• You can also contact info@serl.ac.uk if we are not able to answer all the questions during the session.
Agenda

• Overview of Smart Energy Research Lab (SERL) project
• SERL data
• SERL Research
  • SERL research programme – example projects
  • SERL Observatory – initial analysis
  • Covid19 project
• Data Governance
• Current state of play
• Q & A
SERL Project Overview

• 5-year project funded by UKRI until August 2022
• Consortium of 8 partners led by UCL
• Aim: provide an energy data resource for the UK research community
  • High-resolution smart meter data
  • Linked contextual data
  • Facilitate innovative research
• Recruit and collect data for 10,000 GB households
  • With informed consent
  • Exceeded target and recruited over 13,000 GB hholds
• SERL Research Programme – research utilising SERL data
Why do we need SERL?

• Historically, and currently, very difficult for researchers to access good quality demand-side energy data in the UK

• Smart meter data could be a game-changer – high resolution (HH) data

• However substantial barriers to accessing smart meter data
  • Technical
  • Legal
  • Financial

• Hence SERL funded to be a central resource for the UK research community

• SERL’s focus is on enabling research investigating energy demand/consumption etc in domestic buildings
  • Particularly research that requires use of granular, household level energy data
Goals of the research portal

• **A trusted data resource** for researchers to utilize large-scale, high-resolution energy data

• An effective mechanism for linking energy data with other **contextual data**:
  • from surveys (e.g. SERL survey, EHS)
  • administrative data (e.g. EPCs)
  • individual research projects (e.g. heat pumps, PV, EV etc)

• **Rigorous data management** to ensure fit-for-purpose data provisioned to researchers
Participant Recruitment

Observatory

- Initial target to recruit 10k households to our core Observatory panel
  - Representative of GB households
  - Cold mailing (no names) to households with SMETS2 meters
  - Participants signed up online or by post
  - Actually recruited over 13k participants

- Wave 1 (Pilot Phase): Aug-Sept 2019
  - 1700 households recruited. Response rate ~9%
- Wave 2: Aug-Sept 2020
  - 3k participants recruited. Response rate ~6%
- Wave 3: Jan-March 2021
  - 8k participants recruited. Response rate ~9%

Laboratory

- Laboratory projects recruit their own participants and include consent for SERL to collect data
Electricity data
Daily, Half-hourly
All participants (in theory)
Up to 12 months before consent, ongoing collection

Energy Performance Certificate (EPC)
~50% of participants
Sourced from EPC Register

SERL Survey
~40 questions on the dwelling, and household. One-off collection on sign-up

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

Weather data
ECMWF ERA5 reanalysis data
Hourly, 30km resolution
20+ variables

Gas data

SERL Observatoty Dataset

SERL Observatory Dataset

Wave 1 participants (~1700)
• Recruited Aug-Sept 2019
• Data from Aug 2018

Wave 2 participants (~3100)
• Recruited Aug-Sept 2020
• Data from Aug 2019

Wave 3 participants (~8400)
• Recruited Jan-Mar 2021
• Data from Jan 2020
SERL Data Provisioning

Researcher datasets
• Regular updates (3-6 months)
• Robust data Quality Assurance before release
  • Data QA report, data quality flags/scores, data cleaning processes, derived variables

Observatory dataset: available via UKDS – SN 8666
• First edition – released August 2020
  • Wave 1 participants
  • Smart meter data (Aug 2018 to July 2020)
  • Linked to contextual data: SERL survey, EPC, weather (1 variable)
• Second edition – released April 2021
  • Wave 1 & 2 participants
  • Smart meter data (Aug 2018 to Oct 2020)
  • Linked to contextual data: SERL survey, EPC, weather (20+ variables)

SERL Secure Lab environments
• UKDS Secure Lab
• SERL Research Portal (AWS hosted at UKDS)
Example SERL projects

- Covid-19 impact on energy consumption
- ‘Smart’ EPCs
- Annual report
- Linking SERL and the English Housing Survey
- Identifying wintertime comfort in UK Homes (Leeds-Beckett)
- Understanding habitual energy consumption (Southampton)
SERL Observatory - Early research findings
Need for characterizations of energy demand in buildings
Importance of (accurate) models

Figure 6: Histogram of half-hourly gas import readings, excluding those flagged as errors. Restricted to readings under 10 kWh but strictly greater than 0, bin width = 0.2 kWh.

Source of variance in demand

59% Unexplained

41% Explained[1]

Approaches to characterizing energy demand

Results: explaining energy demand in SERL data

Adjusted R²

N=628

Preliminary analysis – Results are subject to change!
Discussion

• Some caveats
• Explaining over 70% of energy consumption compares very well to previous studies
  • Direct comparisons are difficult as SERL is a unique resource
• Value of bringing together SERL contextual data
• Projects harmonizing with SERL survey in future
• Sources of remaining variability?
• Next steps: advance method, covid-19, wave 3, half-hourly data, tariff, etc.
• Come and contribute to research!
Covid19 Project: short and long term impact of the coronavirus pandemic on domestic energy consumption (GB)

- Collaborative project with CREDS
- Following slides utilise a covid19 survey sent to SERL Observatory wave 1 participants
  - Survey data will be released in a future edition of the Observatory dataset for use in approved projects
- Analysis combining survey data and smart meter data is currently in progress
Covid Research: Working from home – before vs. during lockdown

Substantial increase in those always working from home in lockdown.

Preliminary analysis – Results are subject to change!
Timing of activities in and before lockdown

- Having baths
- Having showers
- Having the TV on
- Running the dishwasher
- Running the washing machine
- Using a laptop, computer, or tablet
- Using electric gym equipment
- Using the oven, cooker or grill
- Using the tumble dryer

Preliminary analysis – Results are subject to change!
Robust Data Governance is absolutely fundamental to the development and operation of the SERL research portal

- **Inbound governance** - Data collected by SERL via informed consent from participants (GB households). Full compliance with GDPR, the Smart Energy Code (SEC) and UCL Research Ethics.

- **Outbound governance** - ensures that only projects approved by SERL’s Data Governance Board can access data via a Secure Lab using “5 Safes” protocols.
Accessing SERL data – 5 Safes

Accessing SERL data via a Secure Lab environment:

• **safe people** - all researchers must obtain ONS Accredited Researcher status

• **safe projects** – all projects must be approved by SERL DGB

• safe settings – UKDS Secure Lab / SERL research portal

• safe data – appropriate for secure lab environment e.g. pseudo-anonymised

• safe outputs – via Statistical Disclosure Control
Where are we now (Q2 2021)?

• SERL is fully operational
  • Technical infrastructure
  • Collecting and managing data from over 13,000 hholds
  • Observatory dataset available via a secure lab environment
  • Independent Data Governance Board
  • SERL research programme – 8 projects commissioned
  • Initial analysis of the SERL Observatory dataset suggests it is a valuable evidence-base for research related to domestic energy consumption

• Next steps
  • Research Portal – ongoing development
  • SERL research programme – ongoing research
  • SERL DGB – ongoing review of projects applying to access SERL data
    • Several projects currently in the review pipeline with many more to follow
    • Additional research project applications encouraged
Contact information:

- Email - info@serl.ac.uk
- Website - www.serl.ac.uk
- Research and accessing SERL data - www.serl.ac.uk/researchers
- Newsletter - https://tinyurl.com/SERLUpdate
- UKDS Study Number 8666 - www.ukdataservice.ac.uk
Questions

• Please type your questions into the Q&A area and we will read them out and respond
Acknowledgements

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- There are over 30 members of the SERL Consortium across 8 organisations who have contributed to the development of SERL and thus the content of this presentation