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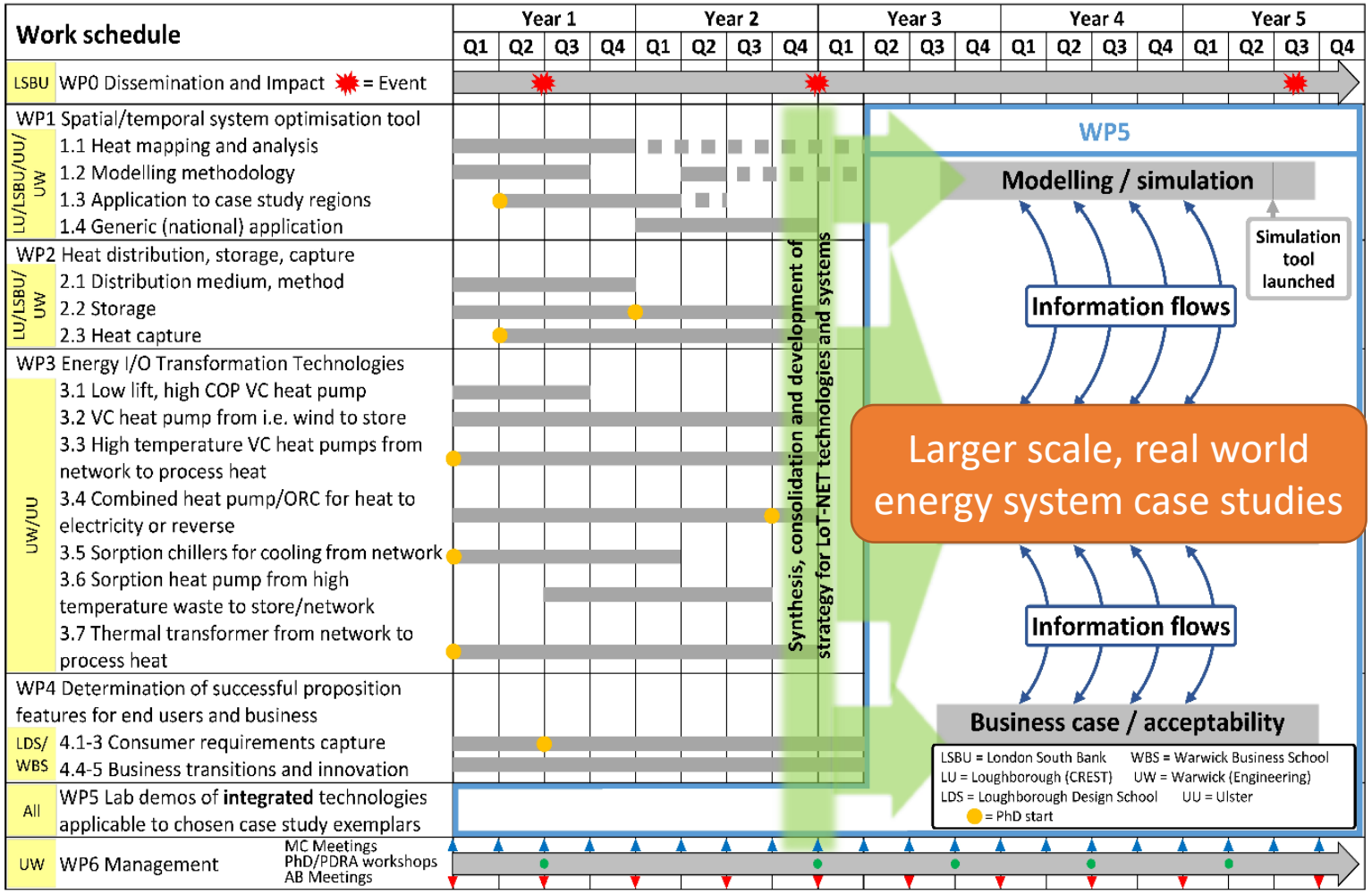
# Advisory Board Meeting 5th October 2021
# Parts 2: Case Studies Update

**Low Temperature Heat Recovery and Distribution Network Technologies**

# Agenda

- Reminder: Ambitions for the Case Studies
  - Larger scale, real world smart local energy system case studies
  - $4^{th}/5^{th}$ Generation Energy Networks – including “LoT-NETs”
- Updates from the case studies
  - Case Study: Loughborough
  - Case Study: Islington
  - Case Study: Warwick
- Discussion & Summary

# **LoT-NET Phase 2**: Including larger scale real world energy systems

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# Case Studies: A reminder

- **Islington: GreenSCIES.** An integrated, Smart Local Energy System (SLES) for a community within the London Borough of Islington. The system is based around an ambient-temperature heat network loop with distributed energy assets such as heat pumps, solar photovoltaic and the flexible integration of electric vehicles.

- **Loughborough town.** Modelling a town. Using modelling to assess different network options that can deliver a net zero heating solution for the domestic dwellings in the town of Loughborough.

- **The University of Warwick.** The campus as a multi-vectoral SLES: electricity, heating, cooling and rising transport demand from EVs. Upgrading district heating to a LoT-NET to achieve scope 1&2 net zero emissions by 2030 & scope 3 by 2050. Resolving consumption vs supply at multiple levels: Campus Level (Energy 2020) and a "smarter" part of campus (Smart Square).

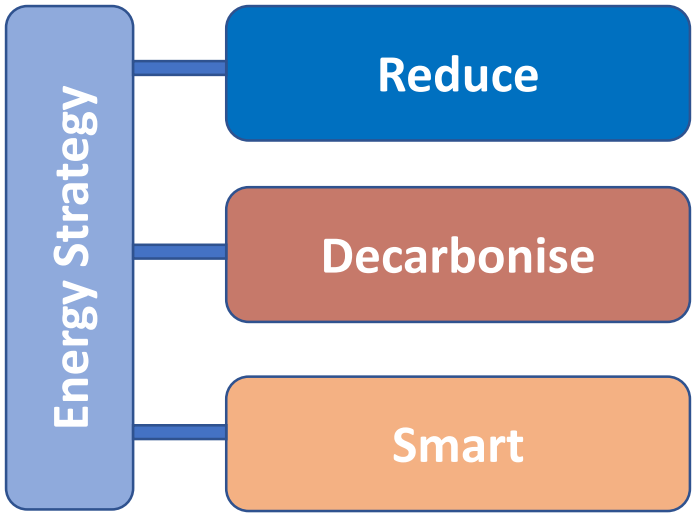
# Case Studies: Last AB we discussed….

- What will the CCC's 20% of heating from heat networks actually be?
- How can LoT-NETs help PFER projects be integrated, multi-vectoral systems, not just an assembly of activities?
- How can LoT-NETs make local energy systems smart and flexible?

- Updates from the Case studies will focus on progress in understanding the role of a LoT-NET and specific LoT-NET technologies/insights in the cases.

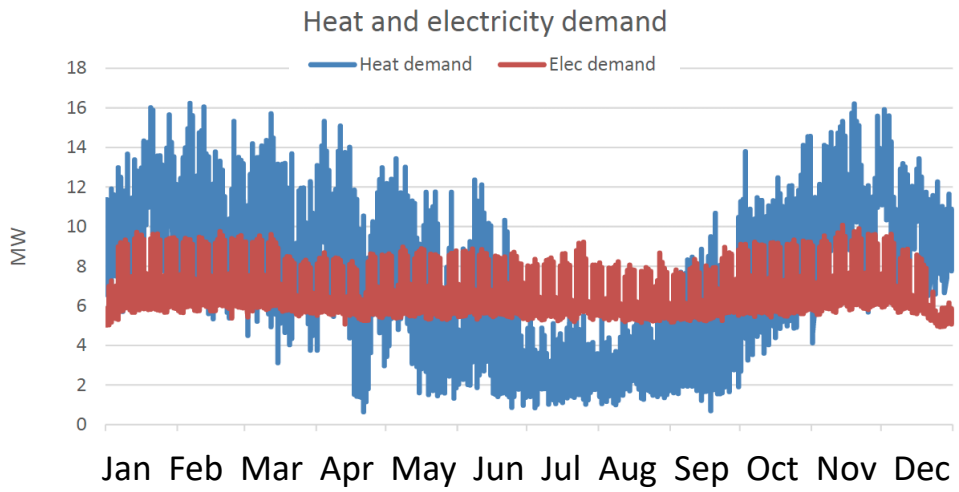
# **Case Study Warwick** – The Integrated Campus Case

- University of Warwick Campus
  - ~£10Mpa spend, community of 34,000
  - Net Zero for Scope 1&2 by 2030
  - Net Zero for Scope 3 by 2050
- Energy & Infrastructure Strategy
- Updates on….
  - Energy 2020 – campus level system that decarbonises supply
  - Smart Square – smart, integrated system using a LoT-NET
  - HNDU Project – UoW/EE/Sweco/BEIS TEF project
  - *The Warwick Standard – better buildings, new and retrofit*
  - *Management of Energy Networks – becoming a local DSO*



# **Case Study: Warwick** – Energy 2020

- Energy 2020 consists of
  - Onsite PV generation (6MW) with battery storage (1MW) and electrical network improvements
  - Campus level ground source Heat Pump (1.4MW).
  - This allows central CHP use to be halved over time and starts shifting district heating from central supply to distributed heat sources & storage.
- Progress since last AB
  - PV etc costed & advancing for investment approval
  - Central HP: preferred approach at the moment is to evaluate the Smart Square LoT-NET further





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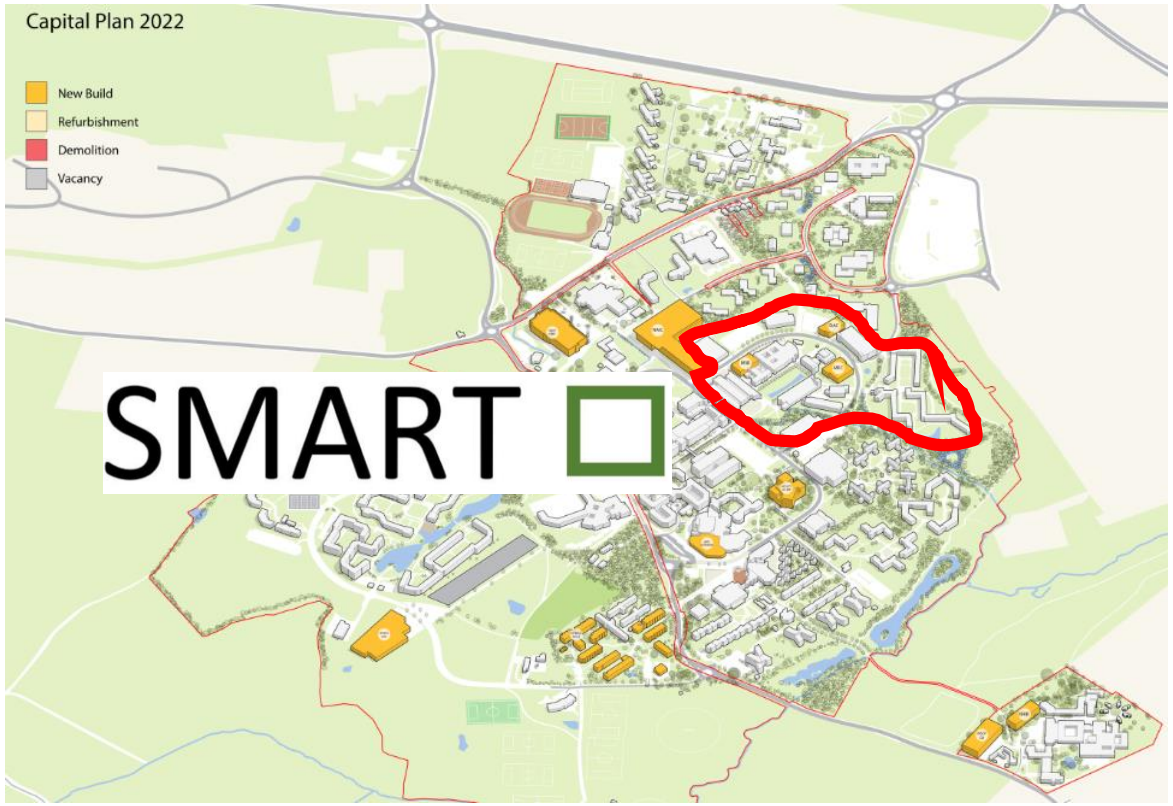
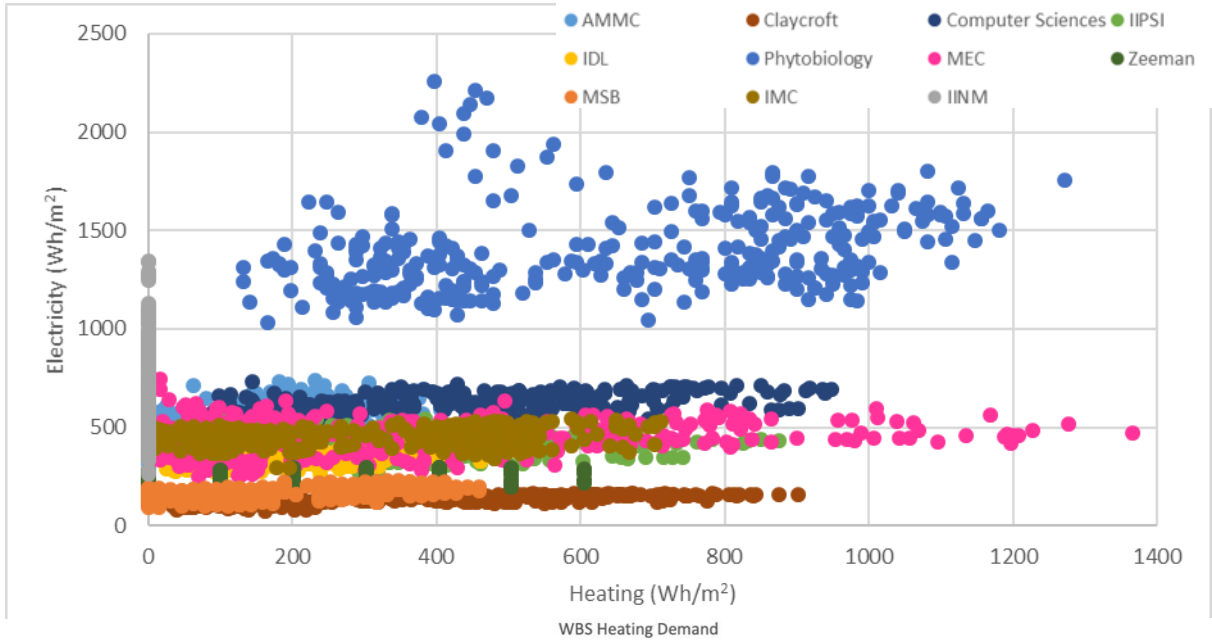
# **Case Study: Warwick** – Smart Square

- Smart Square represents 10% of the University of Warwick Campus
  - 17 buildings, mixed use, 1992-2019
  - 50:50 heat and power use
  - ~£1Mpa energy spend
- Upgrading to include
  - Better buildings, smarter controls
  - A LoT-NET
  - Integrated management across power, heating, cooling and transport.
  - A transactive energy platform.
  - Developing flexibility

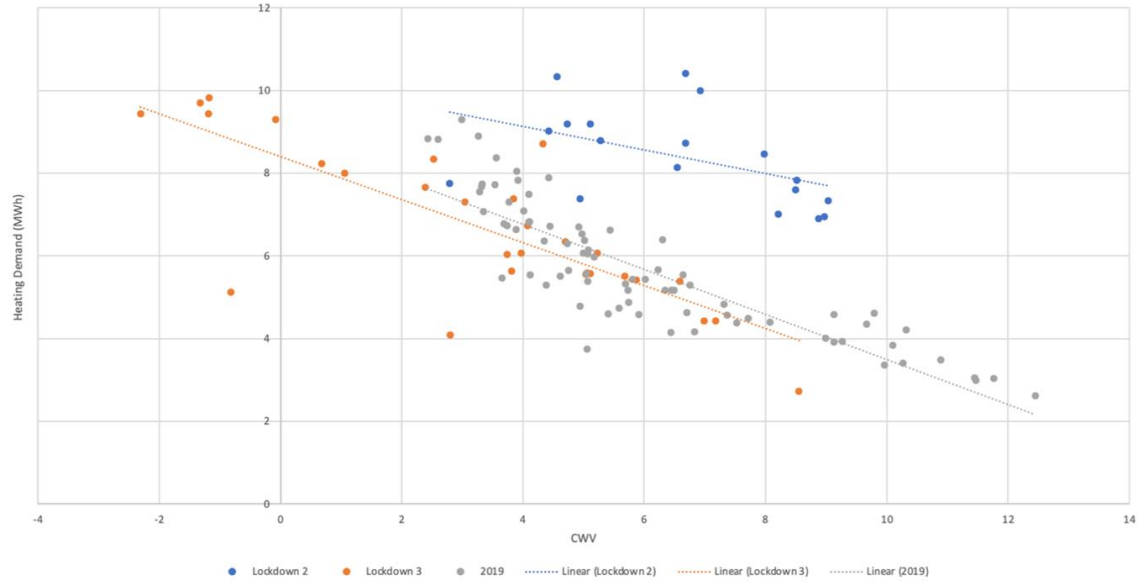


# Smart Square since last AB

- Investment approved to create LoT-NET “loop”
  - Evaluating what HPs to put where – see HNDU project
- Lessons from lockdown: adding heating to electricity
  - Extending work on electricity use to support use of IT cloud services
  - Work on WBS (Solman, UKERC funded) where heat use in full lockdown only fell 6-8%
  - Covid ventilation requirements after full lockdown increased WBS heat use 30-70% depending on outside temperature.
  - New RA to expand this heat analysis to Smart Square
- Smart Square review of building controls
  - Reviews of key assets and actions by Honeywell, Schneider and building managers completed
  - BMS optimisation “Quick wins” offer 600tCO2e (10%) emissions savings for cost of £186k and annual savings of £124k
  - Targeted evaluation programmes for “out of control” buildings
  - Restart consideration of transactive energy when current actions underway




WBS Heating Demand

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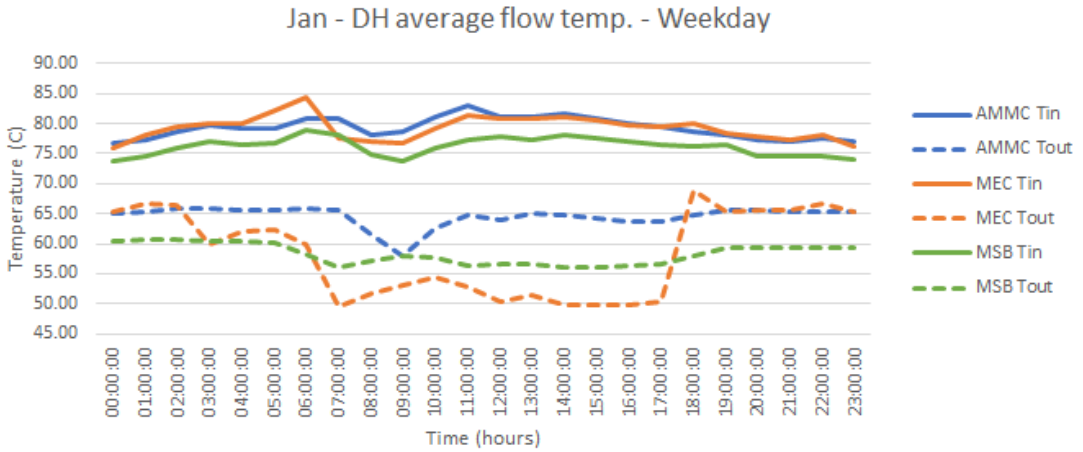
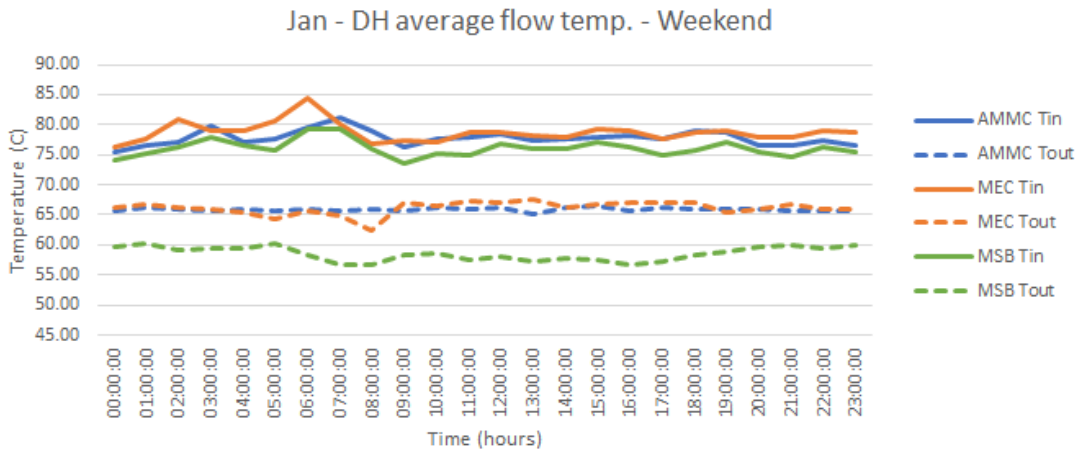
# **Case Study: Warwick** – Smart Square HNDU project

- Details
  - Developing modelling capabilities to design the LoT-NET for Smart Square
  - BEIS/HNDU supported project with Element Energy, Sweco and UoW
- Progress since last AB
  - Project established; some ongoing debates on outputs!
  - Data collection complete
    - Overall: Flow 75-85°C, Return 50-65°C
  - Modelling with Thermos, energyPRO and TRNSYS underway

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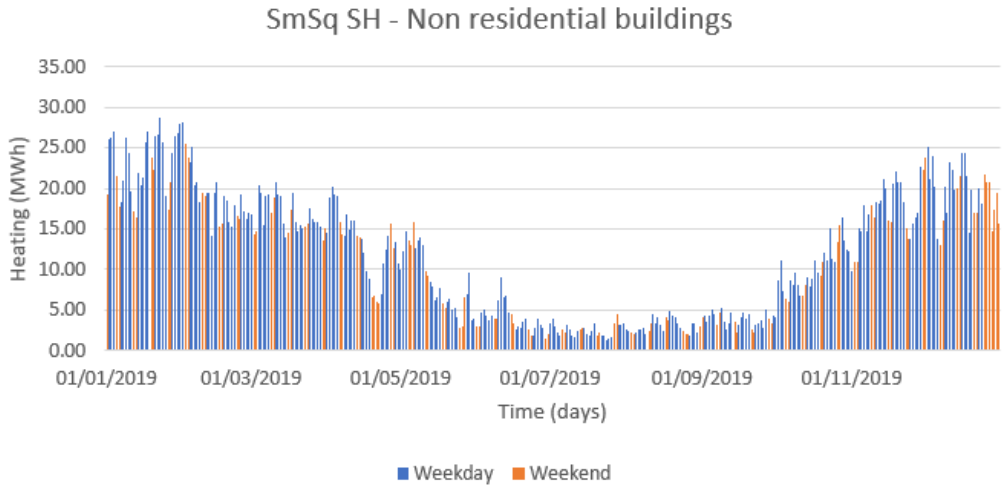
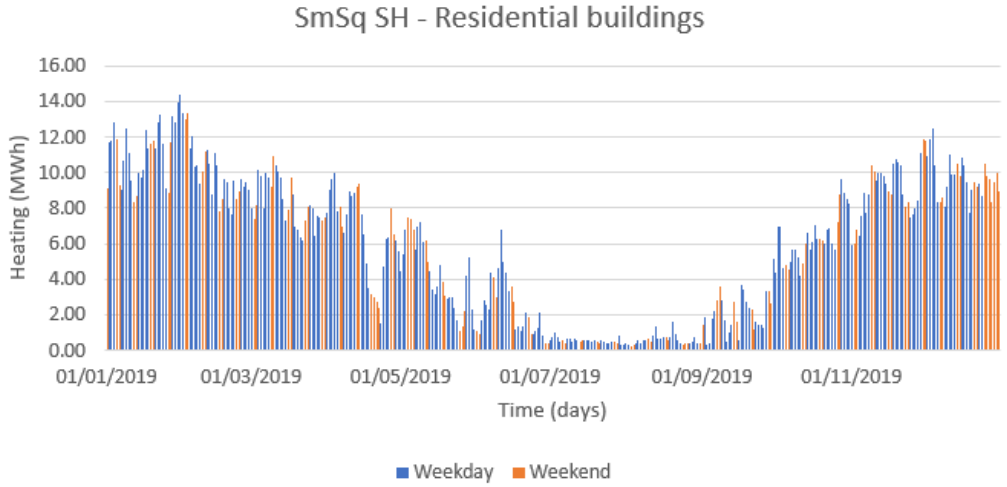
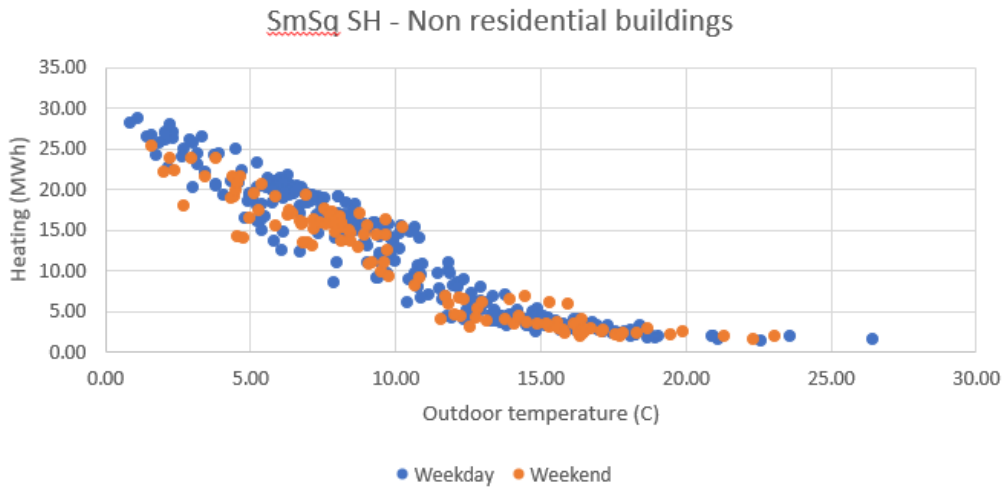
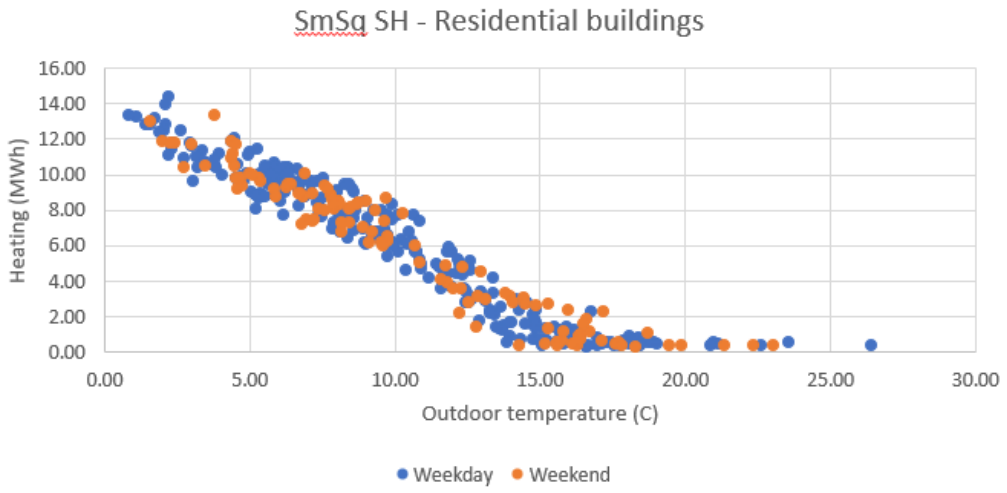
# **Case Study: Warwick** – Smart Square Space Heating

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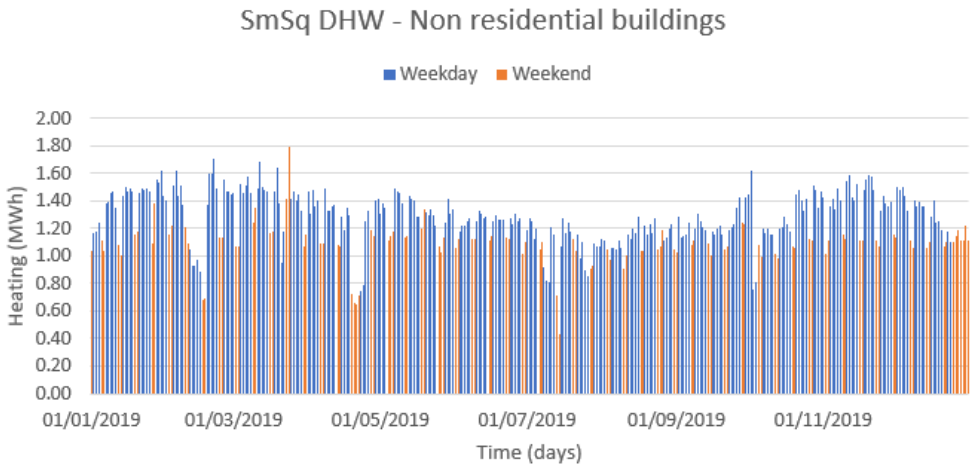
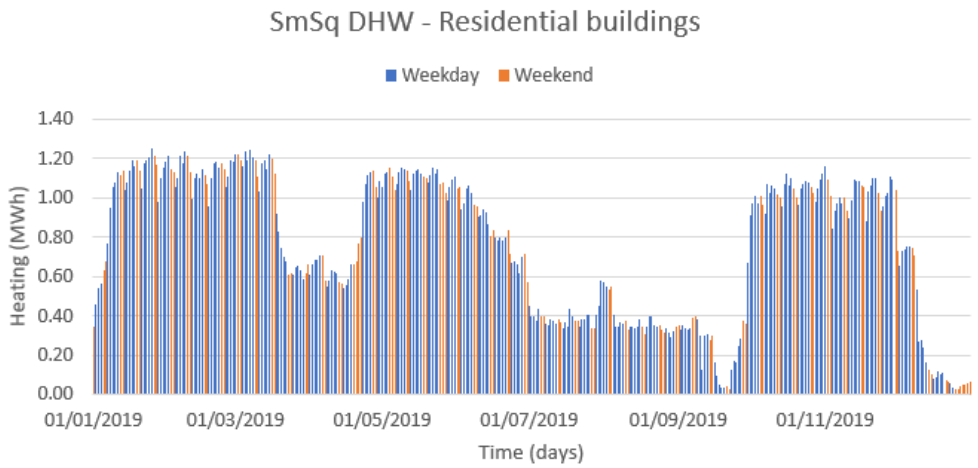
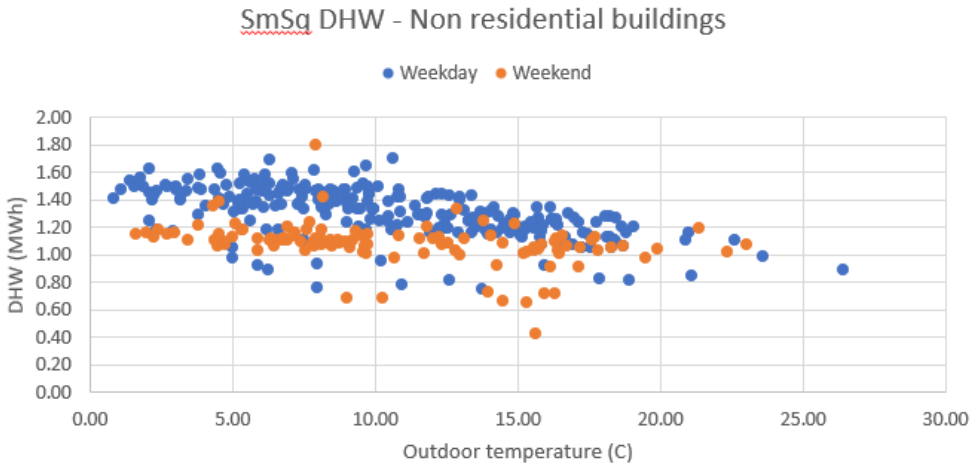
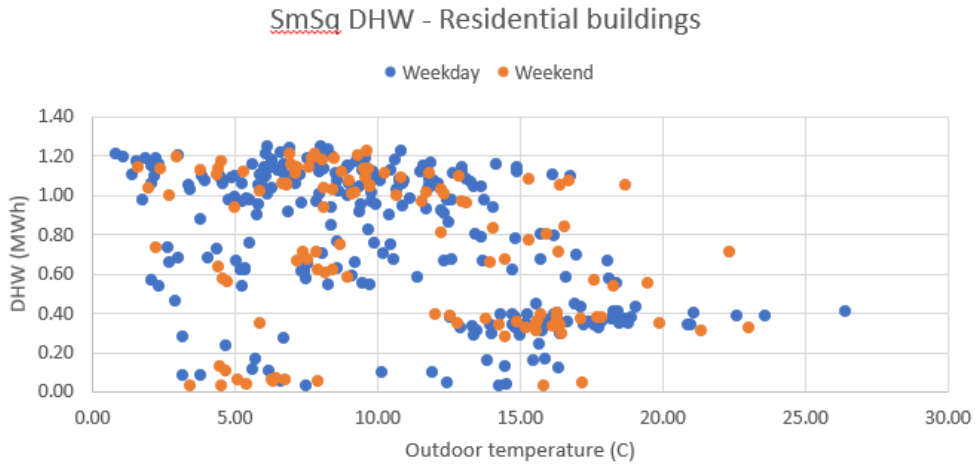
# **Case Study: Warwick** – Smart Square Hot Water

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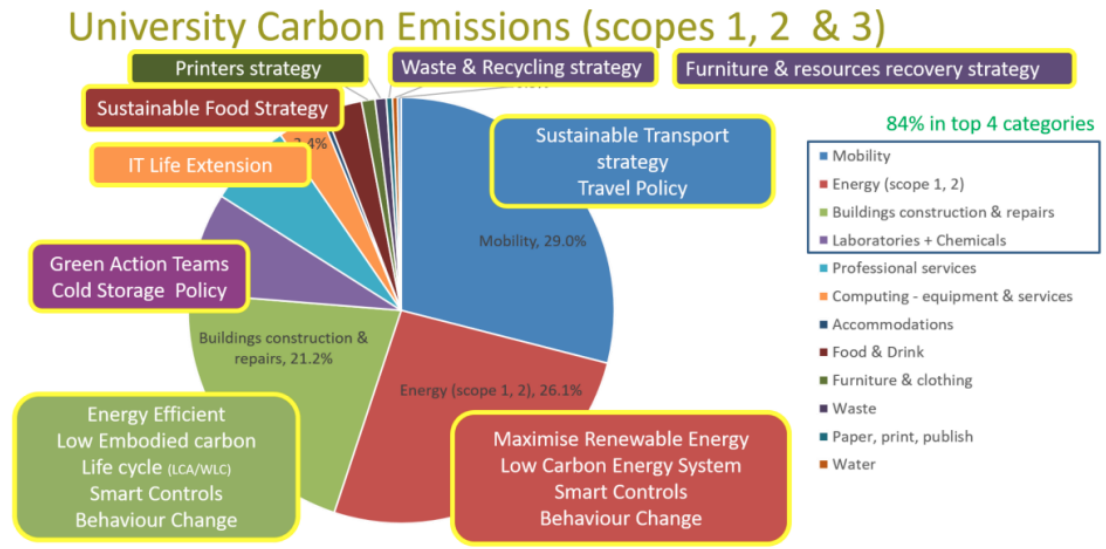
# **Case Study: Warwick** – Warwick Standard

- Applying the standard to Smart Square
  - 9 out of the 17 buildings are top quartile vs building standards
  - Two new buildings on campus have received RIBA awards
- Scope 3 Emissions Details
  - UoW Scope 3 emissions *estimated* as 93,000 tCO2e in 2019/20 vs Scope 1+2 of 38,000
  - Construction & repairs was 21% of emissions
  - IBRB example: 50% manufactured offsite

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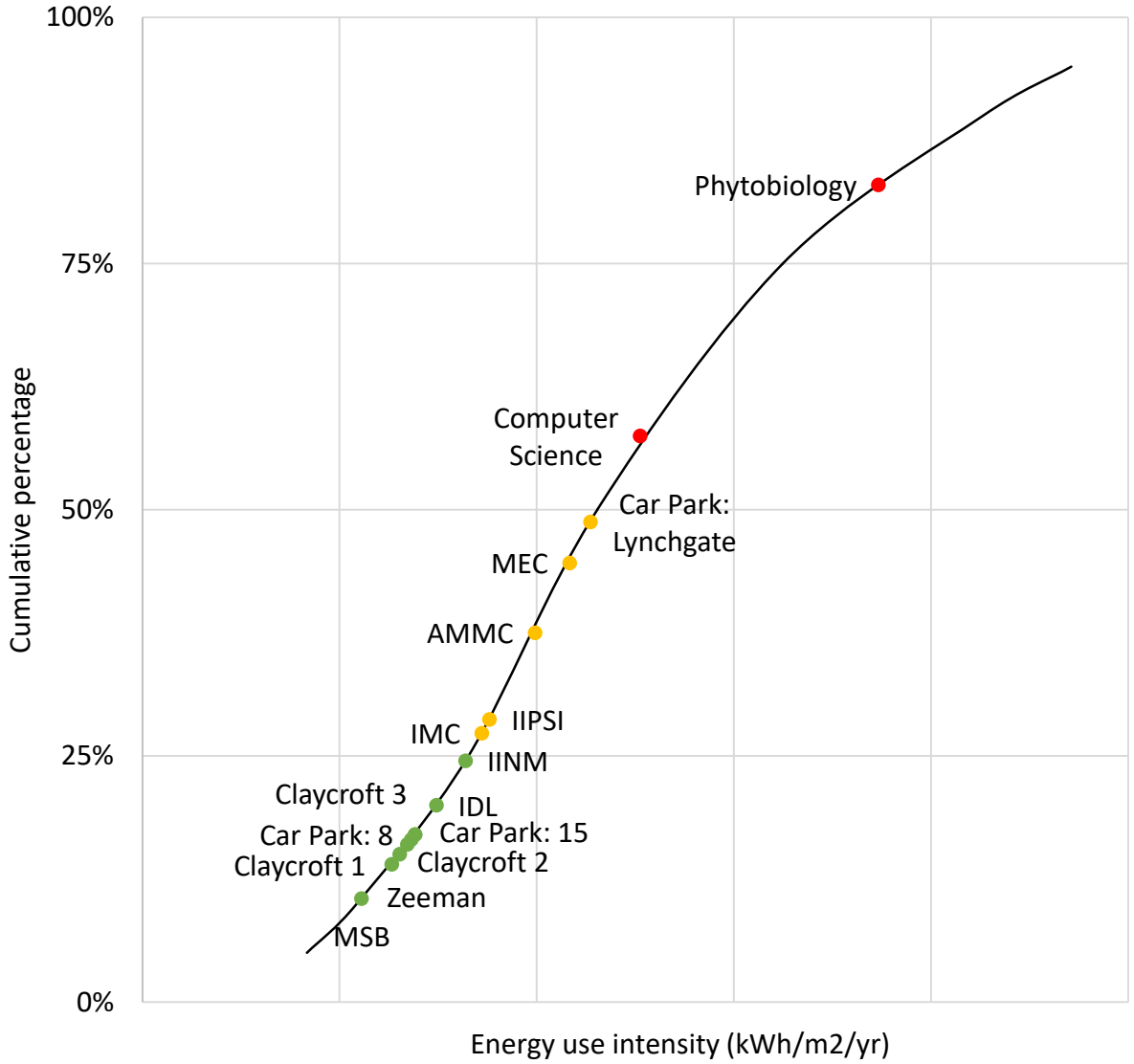
# Case Studies: Summary & Discussion

- Three cases:
  - Urban SLES (4,000-33,000): Integration around a LoT-NET, PFER DD
  - Town (70,000):  Modelling capability to deliver net zero heat at minimal cost
  - Campus SLES (34,000 community): Developing a LoT-NET, PFER DD-linked

- Questions for discussions after the break
  - How do LoT-NETs move us on from existing ideas of heat networks?
  - How do the technologies we are developing move us on from existing ideas of HPs?
  - How can these areas of knowledge best inform the current debate?

# Back-up slides

| Building | Total energy real (kWh/m2) | Total good practice energy benchmark (kWh/m2) | Total good practice energy benchmark Weather adjust (kWh/m2) +3% | Total typical energy benchmark (kWh/m2) | Total typical energy benchmark Weather adjust (kWh/m2) +3% |
|---|---|---|---|---|---|
| **IMC** | 256.78 | 240.94 | 248.17 | 331.34 | 341.28 |
| **Claycroft 1** | 198.48 | 245.00 | 252.35 | 294.00 | 302.82 |
| **Claycroft 2** | 195.76 | 245.00 | 252.35 | 294.00 | 302.82 |
| **Claycroft 3** | 205.35 | 245.00 | 252.35 | 294.00 | 302.82 |
| **Computer Science** | 402.35 | 225.46 | 232.22 | 348.18 | 358.63 |
| **Zeeman** | 167.99 | 224.18 | 230.91 | 345.37 | 355.73 |
| **IDL** | 204.05 | 227.32 | 234.14 | 392.46 | 404.23 |
| **IIPSI** | 263.50 | 232.01 | 238.97 | 393.54 | 405.35 |
| **Phytobiology** | 533.25 | 263.40 | 271.30 | 310.88 | 320.21 |
| **IINM** | 251.92 | 247.80 | 255.23 | 348.71 | 359.17 |
| **AMMC** | 301.62 | 255.40 | 263.06 | 330.28 | 340.19 |
| **MSB** | 144.07 | 224.70 | 231.44 | 382.55 | 394.03 |
| **MEC** | 305.18 | 246.02 | 253.40 | 310.15 | 319.45 |
| **DAC** | Not applicable | 230.84 | 237.77 | 289.30 | 297.98 |
| **Car Park: 8** | 3.63 | 4.60 | 4.74 | 6.60 | 6.80 |
| **Car Park: 15** | 3.58 | 4.60 | 4.74 | 6.60 | 6.80 |
| **Car Park: Lynchgate** | 6.69 | 4.60 | 4.74 | 6.60 | 6.80 |




# CIBSE Energy Benchmark

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