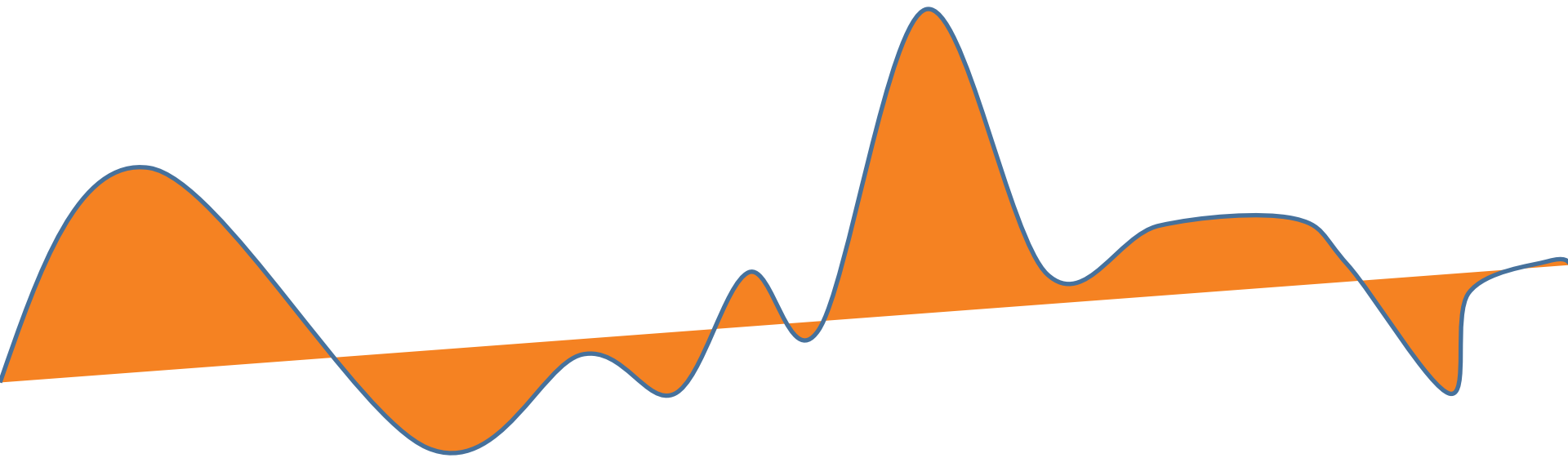


“Shifting Routines, Changing Demand”:

A workshop on the dynamics of household energy demand during daily and network peaks



2-2:15pm Welcome

Wifi network

Name: DEMAND

Password: shifting
(Better than eduroam!)

Professor Gordon Walker, Co-Director, DEMAND
Centre

Yolande Strengers, Centre for Urban Research, RMIT
University, Australia

Ben Anderson, Sustainable Energy Research Centre,
University of Southampton

Mike Hazas, School of Computing and Communications,
Lancaster University

5 Years 2013-2018

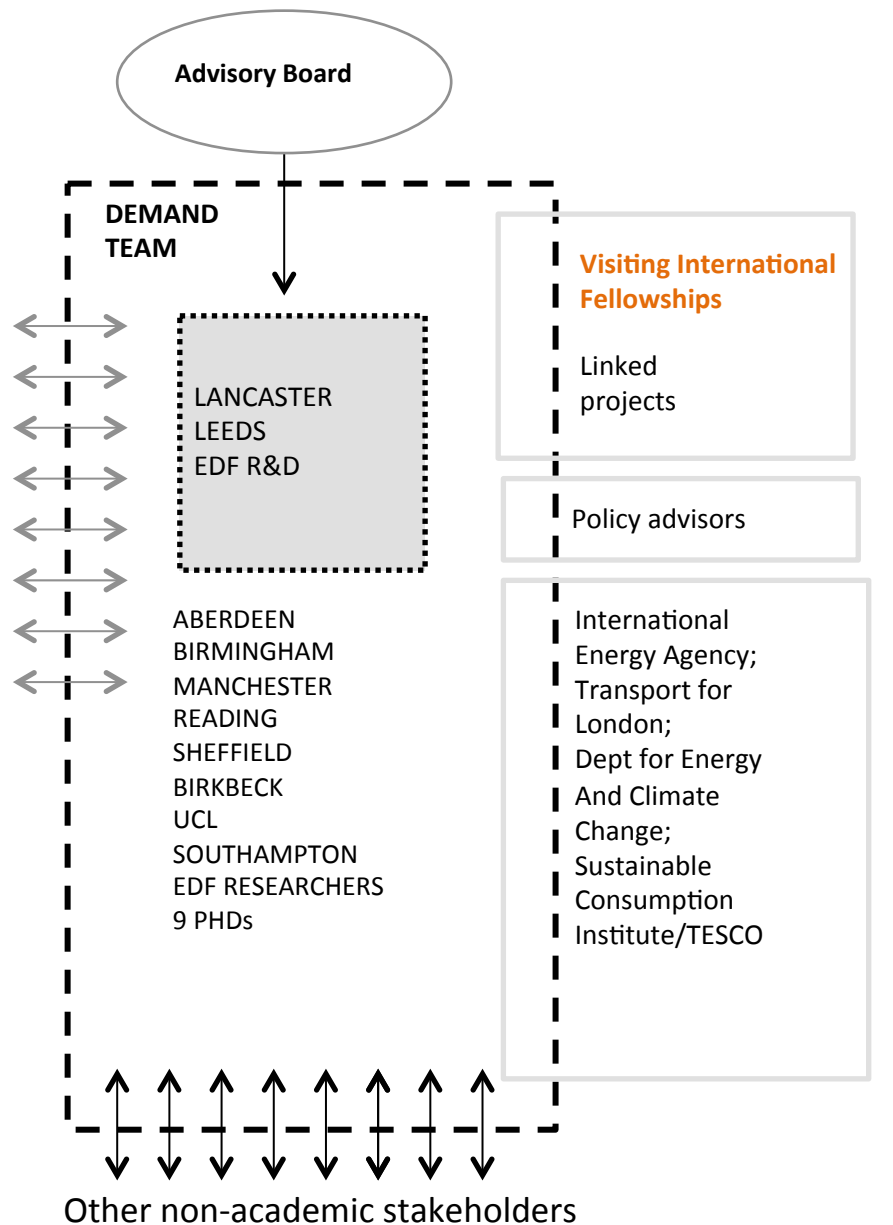
One of 6 End Use Energy
Demand Centres

www.demand.ac.uk

@DEMAND_CENTRE

National and
international
connections
with business,
policy and
academia.

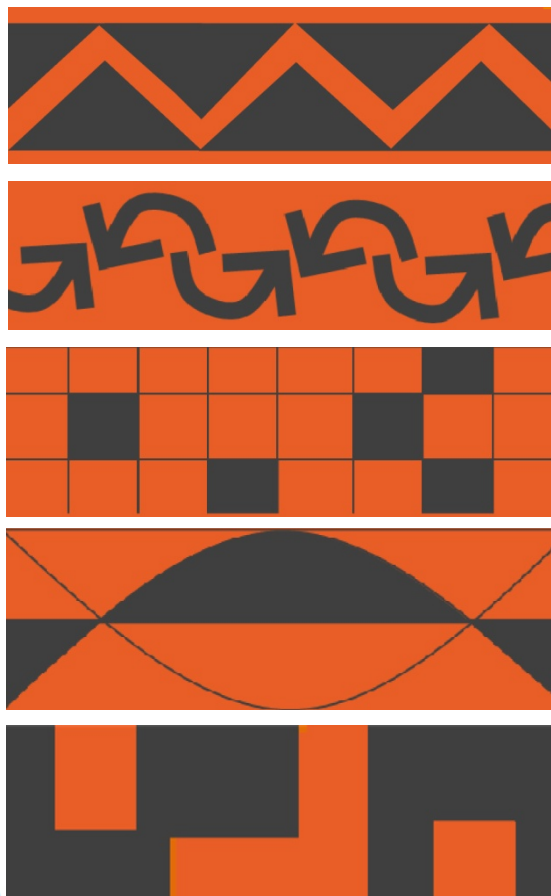
Other EUED centres



Is based on 3 linked propositions

These propositions underpin 5 research themes.

- 1 How and why do end use practices vary
- 2 How and why do end use practices change over time
- 3 How do infrastructures of supply and demand shape end use practices
- 4 What are the implications for normality, need and entitlement
- 5 How is energy demand, constituted, transformed and steered?



1 Energy is used in the course of accomplishing social practices.

2 Social practices and energy demand are shaped by infrastructures and institutions.

3 These systems reproduce interpretations of need and entitlement, and of normal and acceptable ways of life.

Research within these themes allows us to:

Identify and explore new opportunities for **demand** management at different scales.

Achieve a step change in how energy **demand** is understood and managed.

Confront fundamental issues of **demand**: what is energy for?

Workshop aims

Partially informed by the convenors' close analyses of both UK and Australian household data, this workshop aims to provoke reflection and discussion on:

- How and why energy-demanding routines are shifting in time and space, and the impacts of these changes on peak demand and CO₂ emissions
- How demand managers are attempting to shift routines (and to what extent, and in what sense, this is (and is not) working)
- What other programs and policies might shift routines to reduce demand



Workshop overview

Day 1: Introductions

Framing the problem (UK & Australian insights)

What have we missed?

What's already shifting and why?

Over drinks: Matching demand management challenges to provocative responses

Day 2: Discuss demand management challenges & responses (from drinks)

Shifting routine/ changing demand challenges

Responding to key challenges

Reflection on provocative experiments

Next steps



What's in & what's out?

What's linked?

- Basically, everything

What's in?

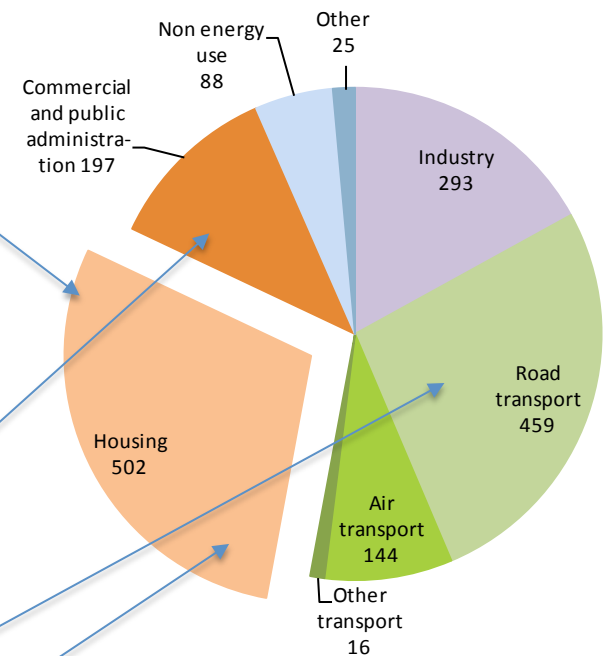
- All 'domestic energy uses'
- But especially those where timing matters

Presumably
cooking fits
here?

But use of a
take-away has a
bit here

And here

And probably
here



Graph 1a: Final energy consumption by sector 2012 (UK, TWh, Total 1,724 TWh)

DECC, 2013 (UK Housing Factfile)

Interventions

We'll be encountering a variety of interventions during the workshop

All inspired by 'traditional' demand management strategies

Aim to provoke reflection and discussion on demand shifting



Intervention: Drink time-of-use (TOU) charging

Currency: Sticker dots. (Colour does not matter.)

Total individual allowance: Five dots

Peak price: Three dots

Off-peak: One dot

Includes: Tea, coffee, hot water and juice. Cold tap water is free.

Time usage grids will be provided near the coffee.

Record time-of-use by placing your dot in the appropriate square.

During peak periods, **stack three dots.**

Drink TOU charging: Peak periods

Wednesday 3:45-4:15pm



Thursday 10:30-11:00am



Peak demand is anticipated during the breaks.

Hot drinks available prior to the breaks.

2:15-2:45pm Introductions

Who are you?

Where are you from?

Why are you here?

How does your work relate to shifting routines/ changing demand?



= 2 mins each

2:45-3:15pm: Framing the problem: UK and Australian perspectives

How flexible is demand?

Why do we need to shift it?

How is it already shifting?

How else could we think about shifting it?



3:15-3:45pm: What have we missed?

Gathering perspectives

Open group discussion

- Questions regarding the presentations?
- What have we missed?
 - How else is energy demand changing that is not captured here?
 - Are there any other aspects of the problem we have missed?
 - What else do we need to take into consideration?

Afternoon tea with
TOU charging up
next!



= 30 mins



Missing?

[studies of renewable-only?]
↳ response varied
CLVR ↑

- substitution & new practices
↳ do X instead
↳ upskilling

- pre-planning

- if disruption is normal
↳ is there resource for adaptation

- know-how & skills & smartness
↳ materialisation

- new tech → how ^{will} people use them in the future?
eg heat pumps
EUs for DNOs
+ clustering

- inequality → esp for critical peak pricing
↳ + vulnerability
+ immobility → "stuck"

- synchronisation of responses → other effects

- data / privacy & surveillance

- batteries, EVs, STORAGE

- Energy data / display / practices — Metrics



- collective activities
- Can we model practices?
- Who loses out through shifting?
 - gendered consequences?
- Why not let the lights go out?
 - ↳ what is the norm & why?

- Should we distinguish services from usage (load on grid) → reading via storage [no need for light]

What else is missing?



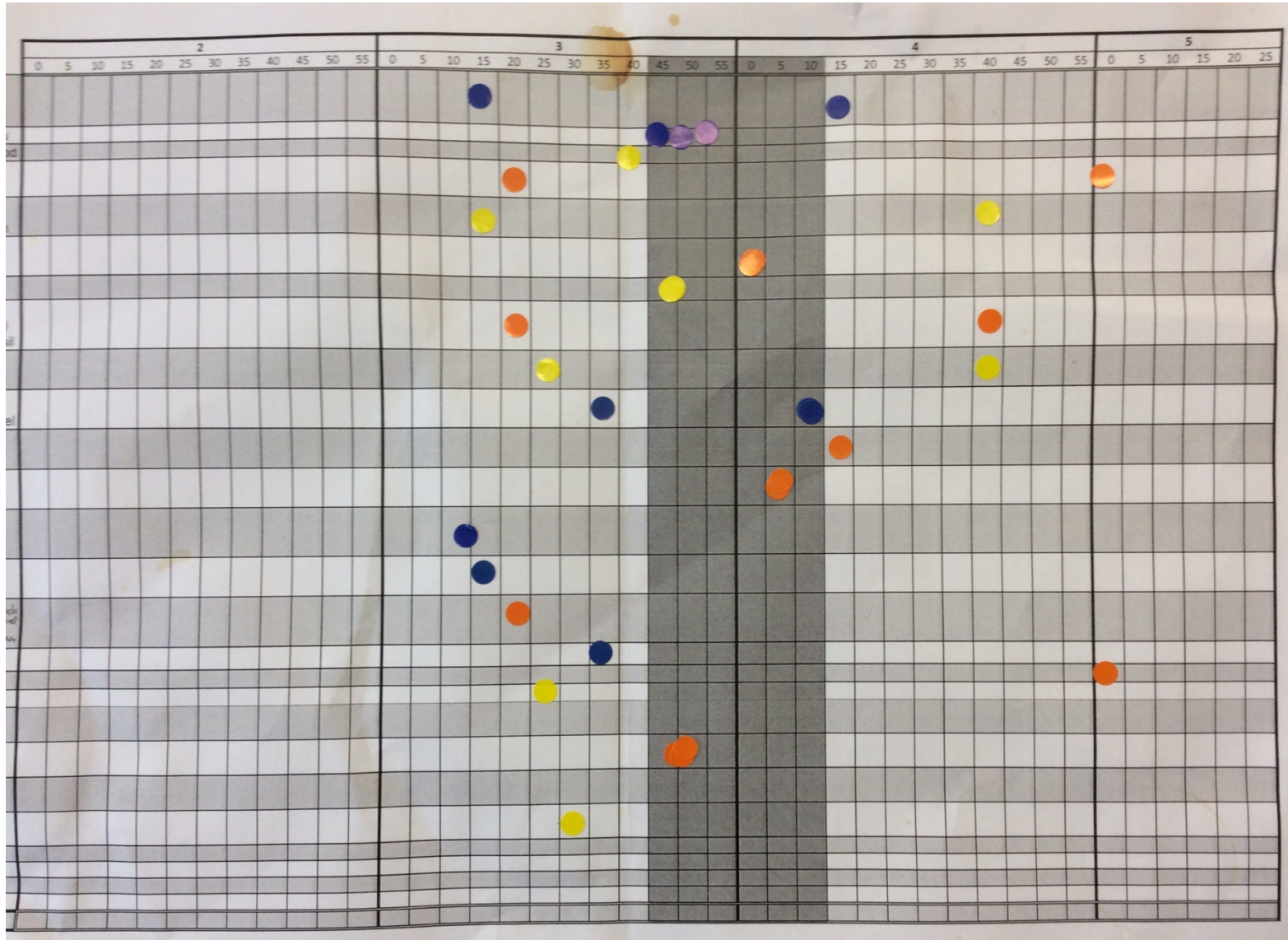
3:45-4:15pm: Afternoon tea

TOU charging in place!

3 dots for hot drink during the 'official' break time



TOU drink charging demand profile (Day 1)



4:15-5:30pm: What's already shifting and why?

Part I of IV: Split into 4 groups

You will need to make lists/ notes on the butchers' paper!

	Group #	
What events or conditions already cause disruptions/ shifts in household routines/ practices that are relevant for energy demand?	1	2
What household routines/ practices are discretionary/ non-discretionary?	3	4

You will have to explain your list to another group!



= 15 mins



4:15-5:30pm: What's already shifting and why?

Part II of IV: Get together as below & explain your notes to each other and then **swap** lists/notes

	Group #	
What events or conditions already cause disruptions/ shifts in household routines/ practices that are relevant for energy demand?	1	2
What household routines/ practices are discretionary/ non-discretionary?	3	4



= 5 mins per group including discussion time



4:15-5:30pm: What's already shifting and why?

Part III of IV: In your original groups but with your **new** list...

	Group #
How could you envisage intervening in what you've been given (to serve a demand management agenda)?	All
What existing demand management initiatives might work in the context of what is already shifting/ not shifting?	

You will have 5 minutes to report back **your top 3** in...



= 20 mins



4:15-5:30pm: What's already shifting and why?

Part IV: In your original groups but with your **new** list...

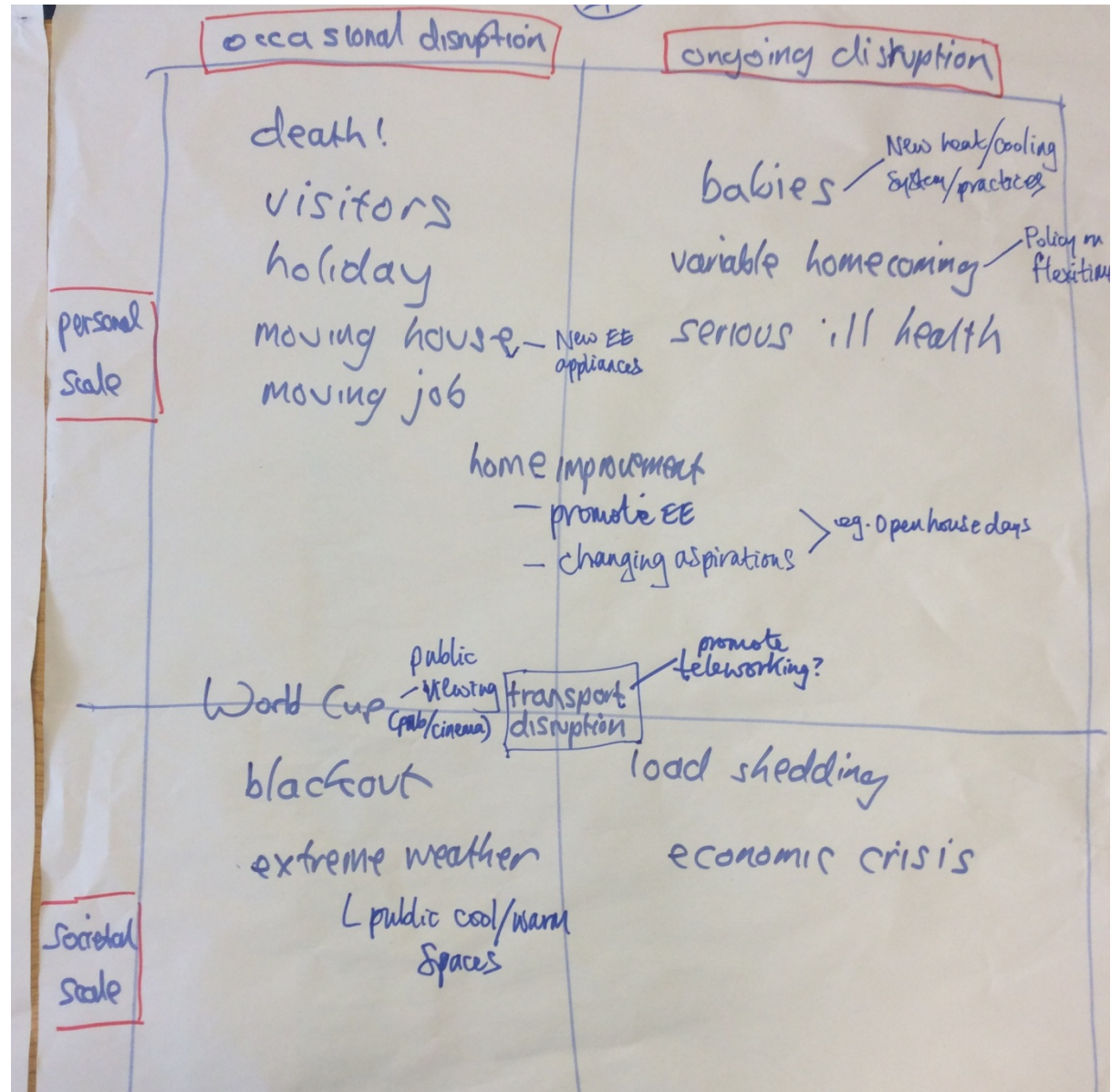
	Group #
Report back on 3 top ideas for intervention/ demand management strategies	All



= 5 mins per group including discussion time



Group 4: what already causes shifts and disruptions?



Group 1: how could you intervene in these existing shifts and disruptions?

1. Open house days
 - 'small is beautiful'
 - real people
 - designing space to actual practices
 - small but efficient (George Clark amazing spaces)
 - Promote through estate agents.
 - For new home owners

2. Hospital advice & technologies / Parents groups
 - cooking & practices.
 - 'real nappies'

3. Public spaces / sharing / communal practices
 - Sporting events in shared spaces
 - Public cool/warm spaces
e.g. libraries / malls / cinemas

Group 2: what practices are discretionary/ non-discretionary?

AND

Group 3: how could you intervene in these practices?

GROUP 4 (original) Technology available Alternatives Income Values Planning

1/E depends! Household structure

NON-DISCRETIONARY

Deadlines e.g. school uniforms cleaning
Lighting for some practices
Sleeping

GROUP 1 (second group)

IDEAS

- Task-based lighting (head torch!)
- ⊕ • Flexible working hours + reduced or increased hours
- Smart plugs come on/off at certain times (though issues about leaving plugs in...)
- Smarter appliances, timers e.g. ~~TV~~ eg recording programmes off TV.
- ⊕ • Communal baths (maybe?)
- ⊕ • Warm spaces outside home people can go to (together with info about turning heating down)
- ⊕ • Communal laundry service
- ⊕ • Promote physical activity
- ⊕ • Shared cooking + dishwashing
- ⊕ • Promote communal activity
- ⊕ • Localised food production
- Building efficiency + thermal mass - to store heat in a home And heat pumps
- ⊕ • Batteries + other storage (e.g. cars battery swapping station + car pool) (hh scale or bigger scaled) - community batteries are more efficient - not need chemical - lake?
- Promote letter writing (issues of transport, economies of scale, off peak writing??)
- ⊕ • Talk to local people

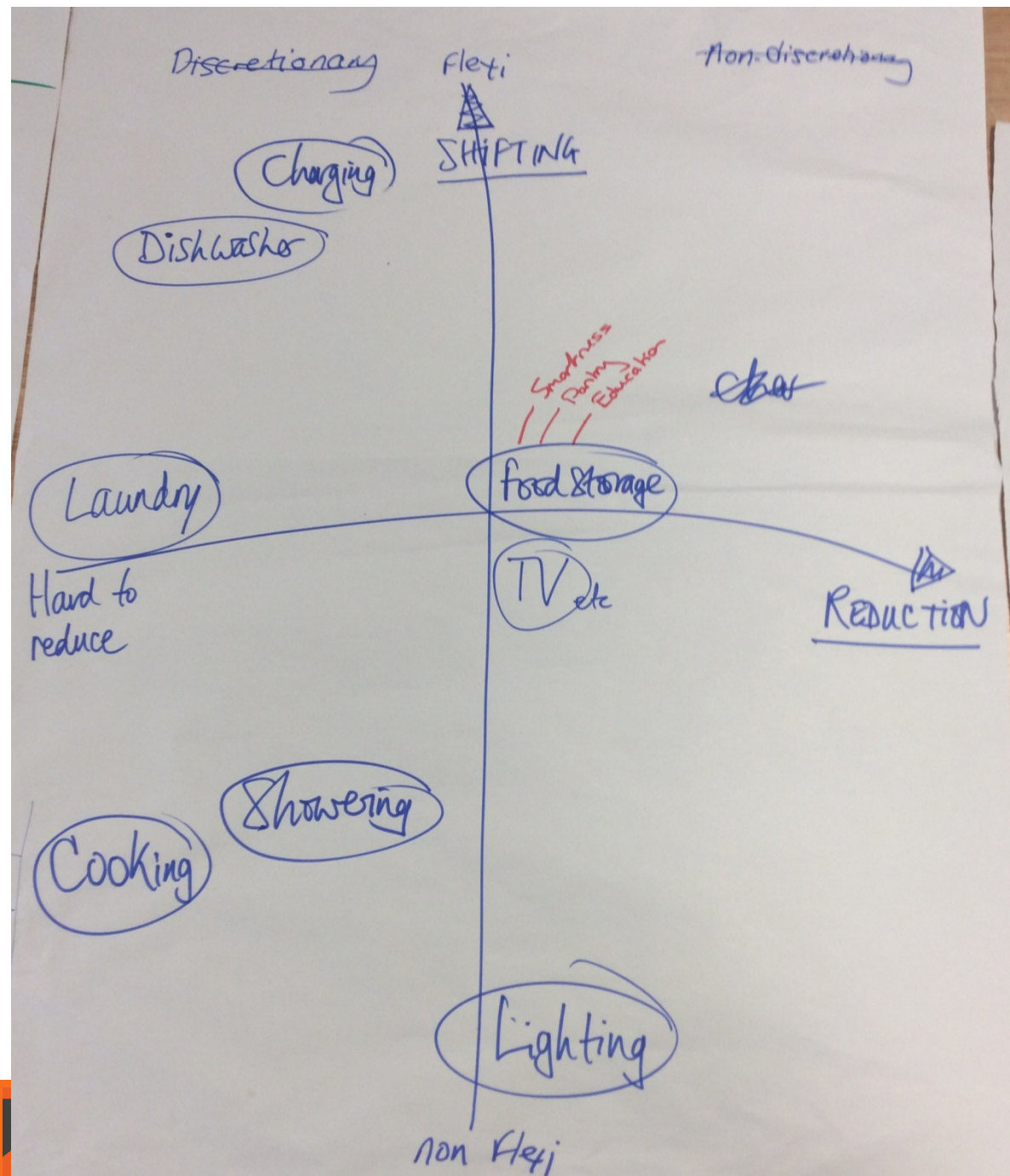
DISCRETIONARY

Communication
Charging batteries/devices
Heating/cooling
Watching TV
Playing computer games
Washing
Dishwashing

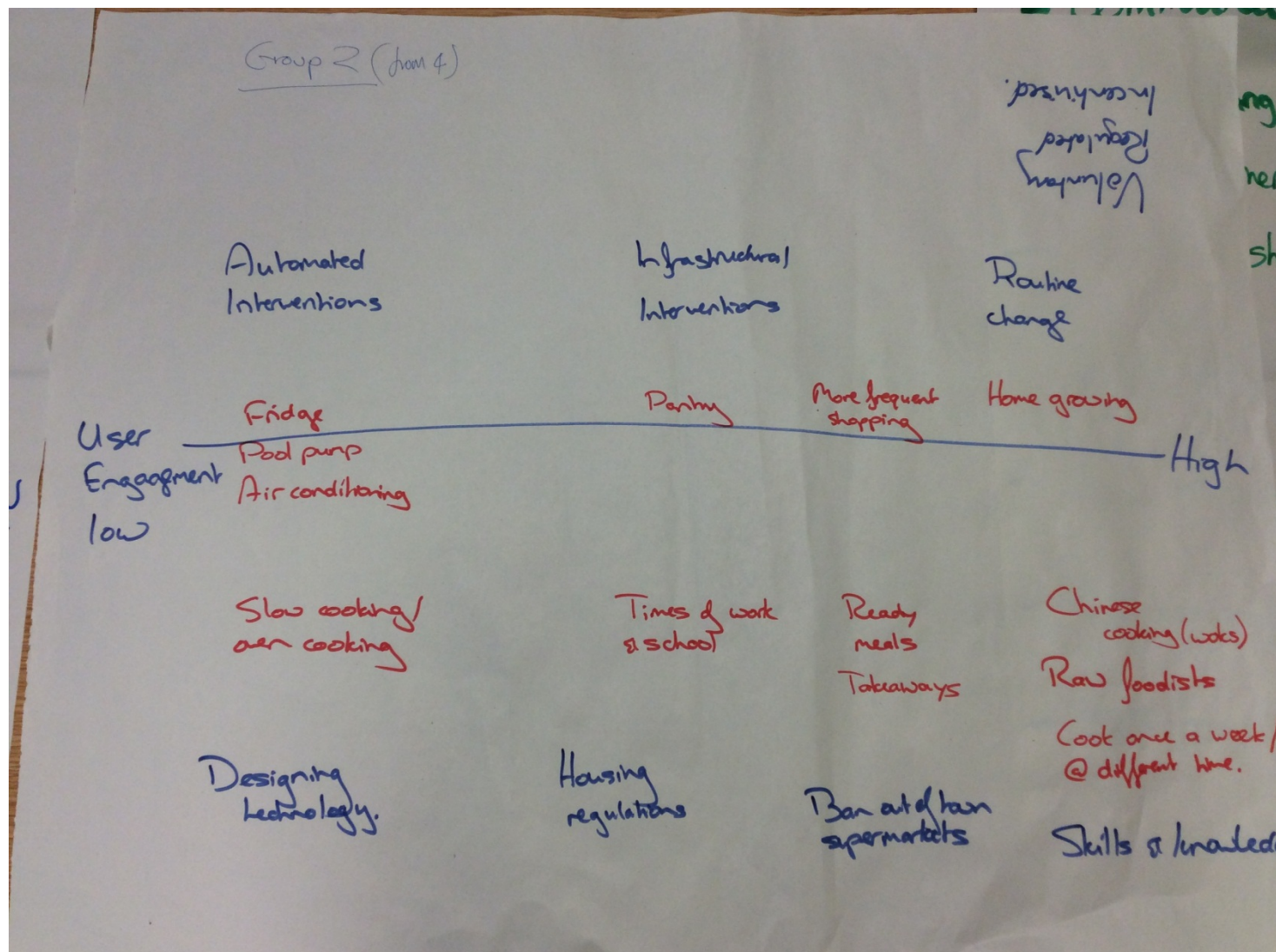
Issues & Os

What is the "right scale" - how much do we localise + how much do we centralise, for efficiency?

Group 3: what practices are discretionary/ non-discretionary?



Group 2: how could you intervene in these practices?



Drinks and dinner activity

Each of you has been given a sticker. **Wear it proudly!**

Responses in **BLACK**, challenges in **RED**.

By collaborating with others, you must figure out:

- How responses might fit with challenges. And, why?
- What (combinations of) responses are appropriate, impractical, or possibly counterproductive?

We have plenty of time. (Drinks 5:45-6:45pm; Dinner 7-8pm)

Talk to as many other people as you can! Discuss and reflect.

Be ready to report what you found in a plenary tomorrow morning.

Intervention: Incentivised Community Reduction Scheme

Objective: Reduce our workshop's electricity and data demand by at least 20%

	Wednesday actual	Thursday maximum
Electricity	2235 watt-hours	1788 watt-hours
Wifi data	1632 megabytes	1306 megabytes

Incentive for success: Juice, and CAKE!

Otherwise: Tap water (and no cake)



9-9:15am Update from Day 1

TOU charging still in place

10:30-11:00am



Don't forget about our 20% reduction target
(and cake).



9:15-9:45: Challenges and responses

Get into your groups from the previous evening:

1. Shifting daily afternoon/ **evening** peak demand
2. Managing critical peaks in heatwaves/coldsnap
3. Shifting daily morning peak demand
4. Reducing demand overall
5. Spreading demand over the week/year

People with responses can still swap groups!

Responses (matched to challenges)

- Reservation/quota system for iPlayer/Netflix/Hulu
- Afternoon cinema tickets are nearly free
- Stagger household member working hours & promote night shiftwork
- Promote/standardise single cup kettles
- Only broadcast East Enders at lunchtime
- Install/promote dog and cat doors in homes with pets
- Promote/provide cool & warm vests for infants
- £500 yearly surcharge for owning an air-conditioner or heater
- Promote brisk showers, pools and water games
- Enact a winter thermal underwear entitlement
- Standardise washing machines that start at 3am
- Work with Marks and Spencer to promote seasonally-appropriate clothing
- Install more walls and doors; outlaw open plan
- Promote snacking, BBQs and uncooked food
- Provide free Tupperware
- Re-open and build public libraries with heating/cooling
- Bring back Laundry Monday



9:15-9:45: Challenges and responses

You have **10 minutes** to discuss how effectively your responses address the challenge:

- Why did you think these challenges and responses go together?
- What did you think about these strategies? Are they realistic/ feasible?
- How else might you address these challenges?

Make sure you write down your ideas!



= 10 mins

You will have 4 minutes to discuss with larger group...

9:15-9:45: Challenges and responses

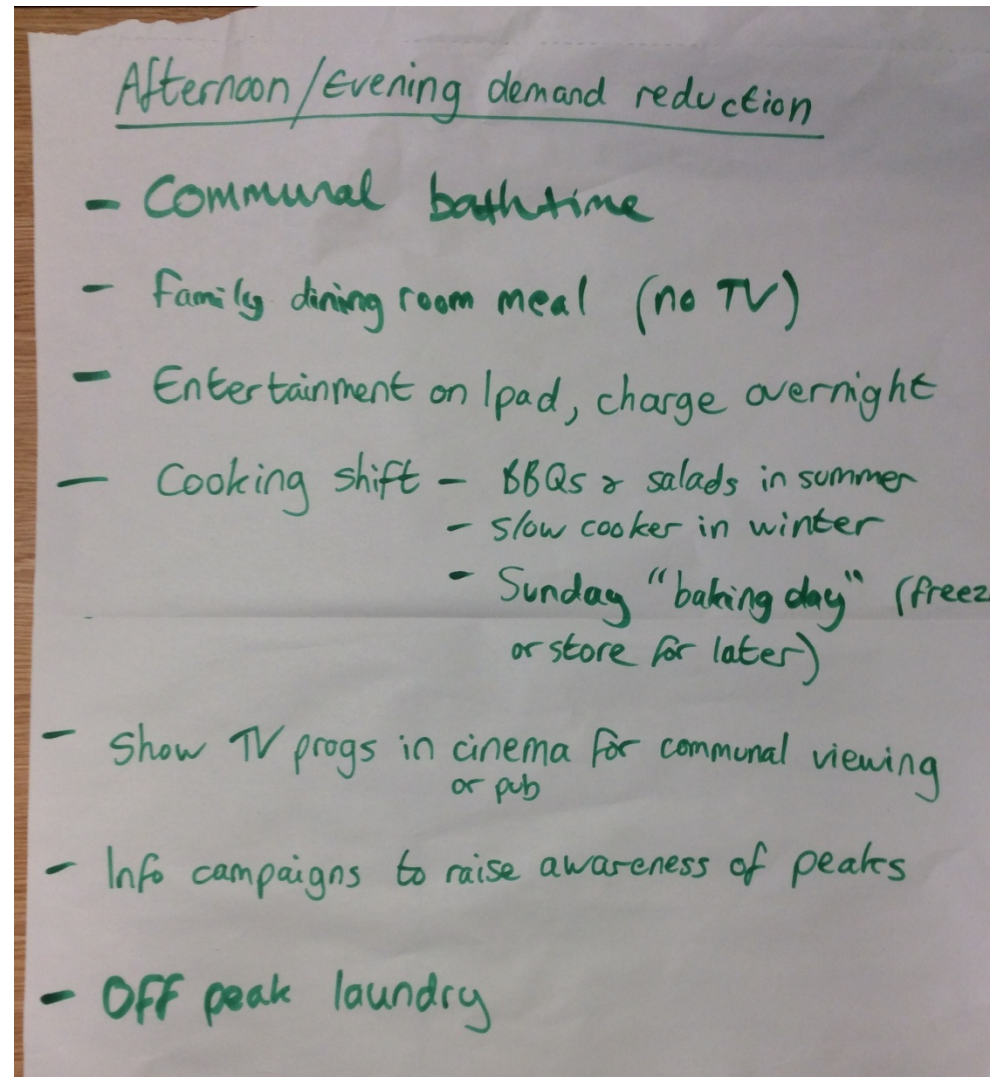
5 groups report back on the responses to their challenges:

- Why did you think these challenges and responses go together?
- What did you think about these strategies? Are they realistic/ feasible?
- How else might you address these challenges?

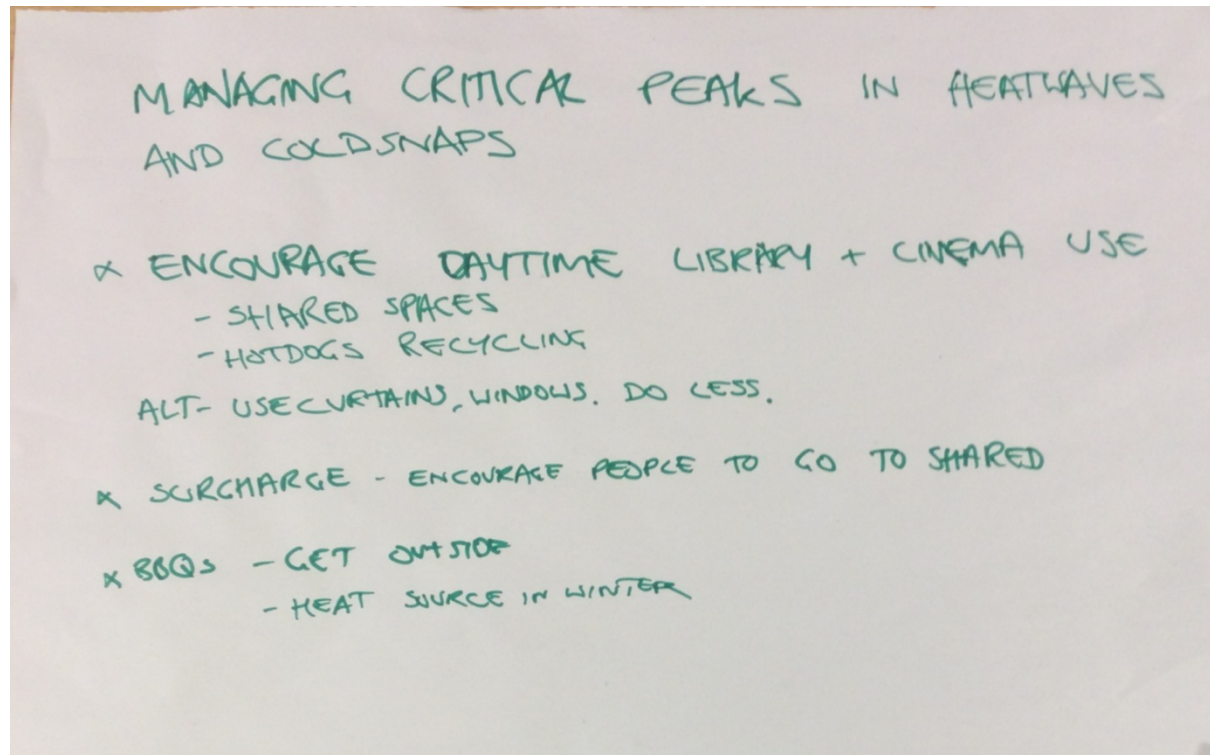


= 4 mins per group including discussion

1. Shifting daily afternoon/ evening peak demand (other ideas)



2. Managing critical peaks in heatwaves/coldsnaps (other ideas)



5. Spreading demand over the week/ year (other ideas)

SPREADING DEMAND OVER
THE WEEK / YEAR

EXAMPLES OF BIG ENERGY ~~DAYS~~ ACTIVITIES
FOR PARTICULAR DAYS:

- OCCASIONAL BATHS
- DINNER PARTIES

Still
assumption
• Bath → still there YES
dinner parties → still there NO
washing time same

9:45-10:10am: Top challenges for shifting routines/ changing demand

Split in 4 groups

Make sure you write down your ideas!

What do you think are the top 3 challenges for **shifting** household routines/ demand?

Discuss and prioritise challenges in terms of their significance for household demand management

You will have 5 minutes to report back & discuss with larger group...



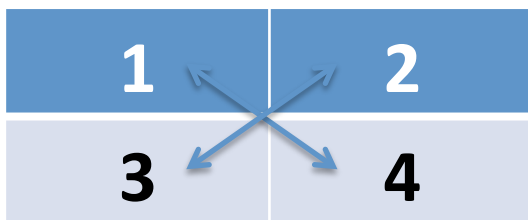
= 25 mins



10:10-10:30am: Top challenges for shifting routines/ changing demand

You have 5 minutes to report back on your top challenges for shifting routines/ changing demand and discuss with the wider group.

SWAP!



= 20 mins

Changing venues

What were our perceptions upon arriving?

The built environment?

How did we respond?

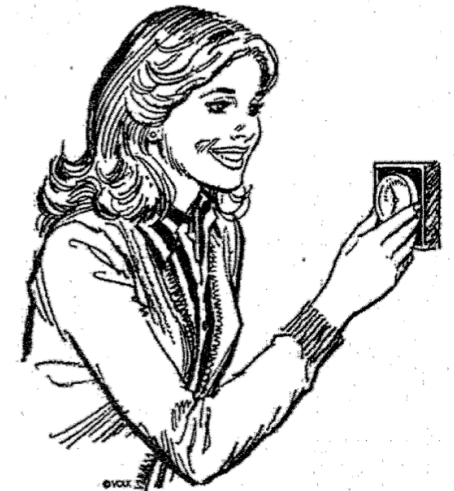
Wednesday after lunch	21.5°
Wednesday before drinks	23.5°
Thursday morning	24.1°
Thursday morning (foyer)	21.0°

How did this change experiences, meanings and doings of/for the workshop?

Intervention: Cool Uni

Meant to stimulate thinking on:

- Automated heating/cooling gone wrong
- Hotter summers in the UK, and a building stock which wasn't built for it
- The adaptive model for thermal comfort



Possibilities in Cool Uni

Open the door/windows

Alter clothing

Relocate

Cold drinks

Just get on with life; become absorbed by other “doings”

Shaped by materials and infrastructures:

- windows (locked)
- air conditioning (controls obscured)
- clothing's practical availability, and socially appropriate possibilities



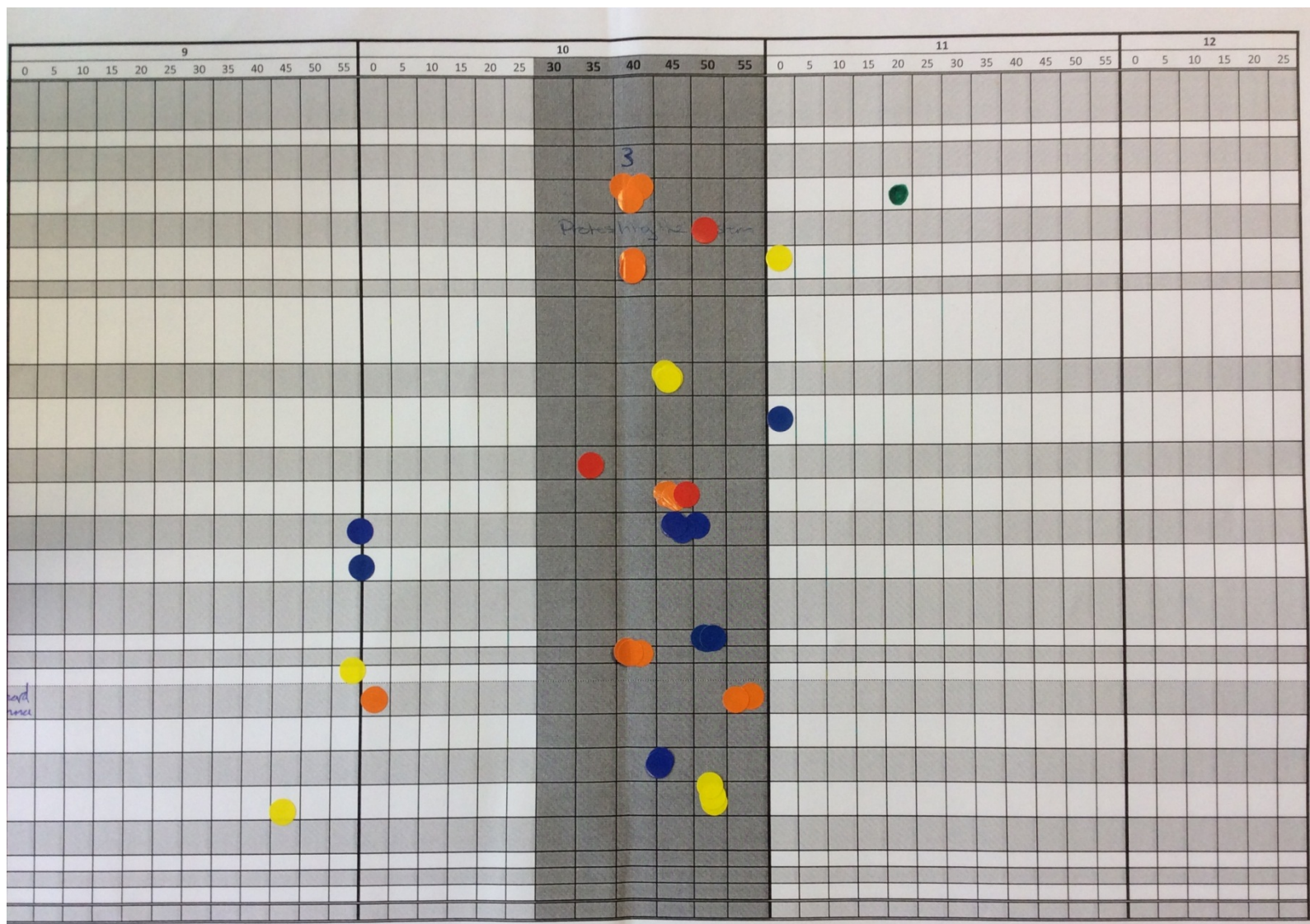
10:30-11:00am: Morning tea

TOU charging in place!

3 dots for hot drink during the 'official' break time



TOU drink charging demand profile (Day 2)



11:00-11:25am: Responding to key challenges

Keeping the same groups and using your **new** list of prioritised challenges...

What strategies, approaches or responses do you think would help address them?

You will have 5 minutes to report back...

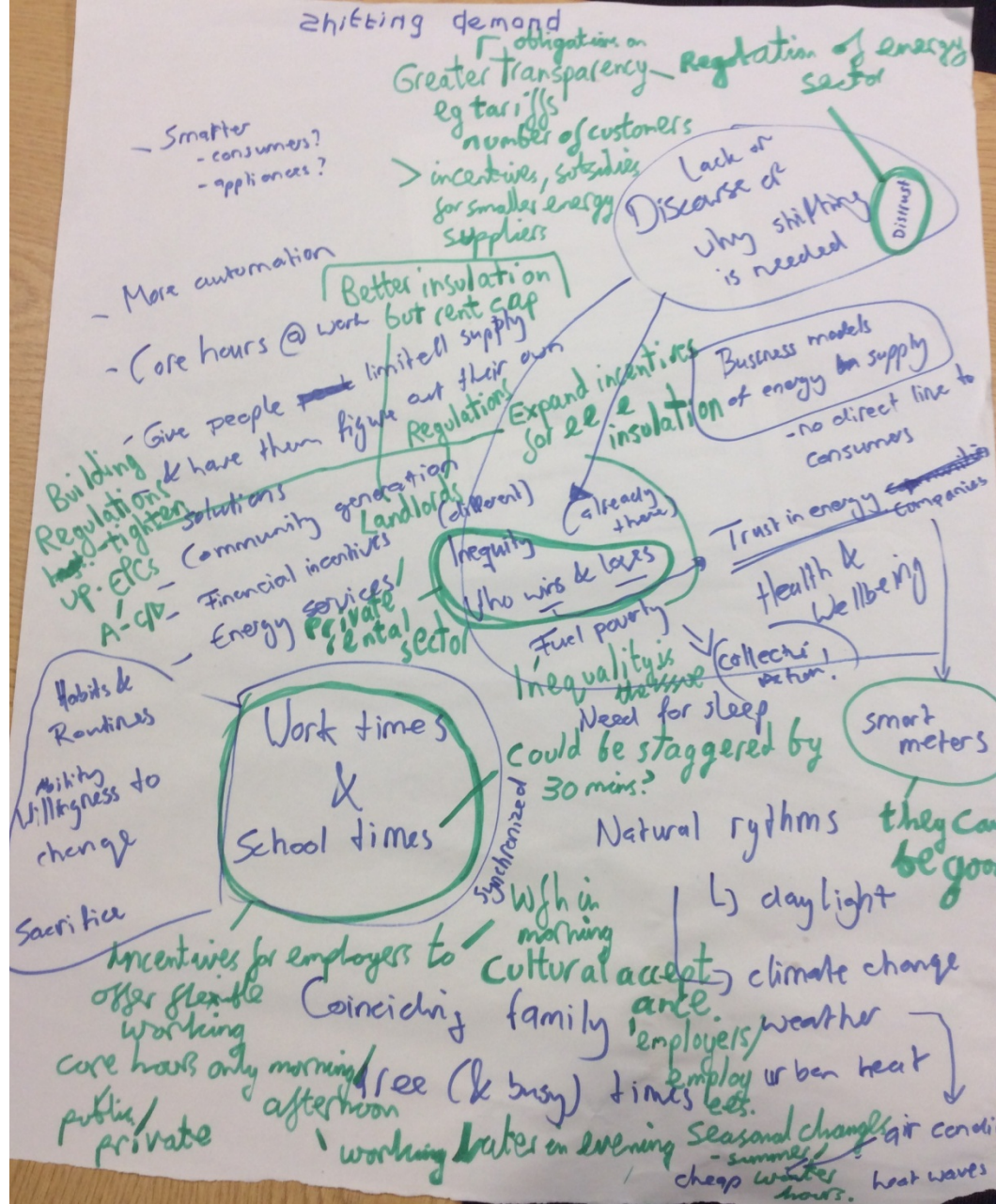
You may need to make notes!

Do not be afraid to innovate!



= 25 mins

Key challenges and strategies



Key challenges and strategies

DATA NEEDS

(*) Sharing the cost-savings → how? Actors & consumers

"NEW INFRASTRUCTURE COMMUNITIES"

"RECLAIMING YOUR SUBSTATION" → GIVE 'EM THE WIRES!

Increasing local distribution problems

→ where & how are incentives placed?

Does this require new infrastructures & actors?

has to be universal & at scale

delivers at average

firm & enforceable

→ to be "contractable"

Increasing peak → only if : electrify heat → heat pumps ?

TRUSTED 3RD PARTY : " transport

ENERGY ADVISORS + SOFTWARE + MEASURING KIT

(*) Local (even dwelling level) matching of microgen & consumption

Peaks (esp critical peaks) = dirty re carbon ?

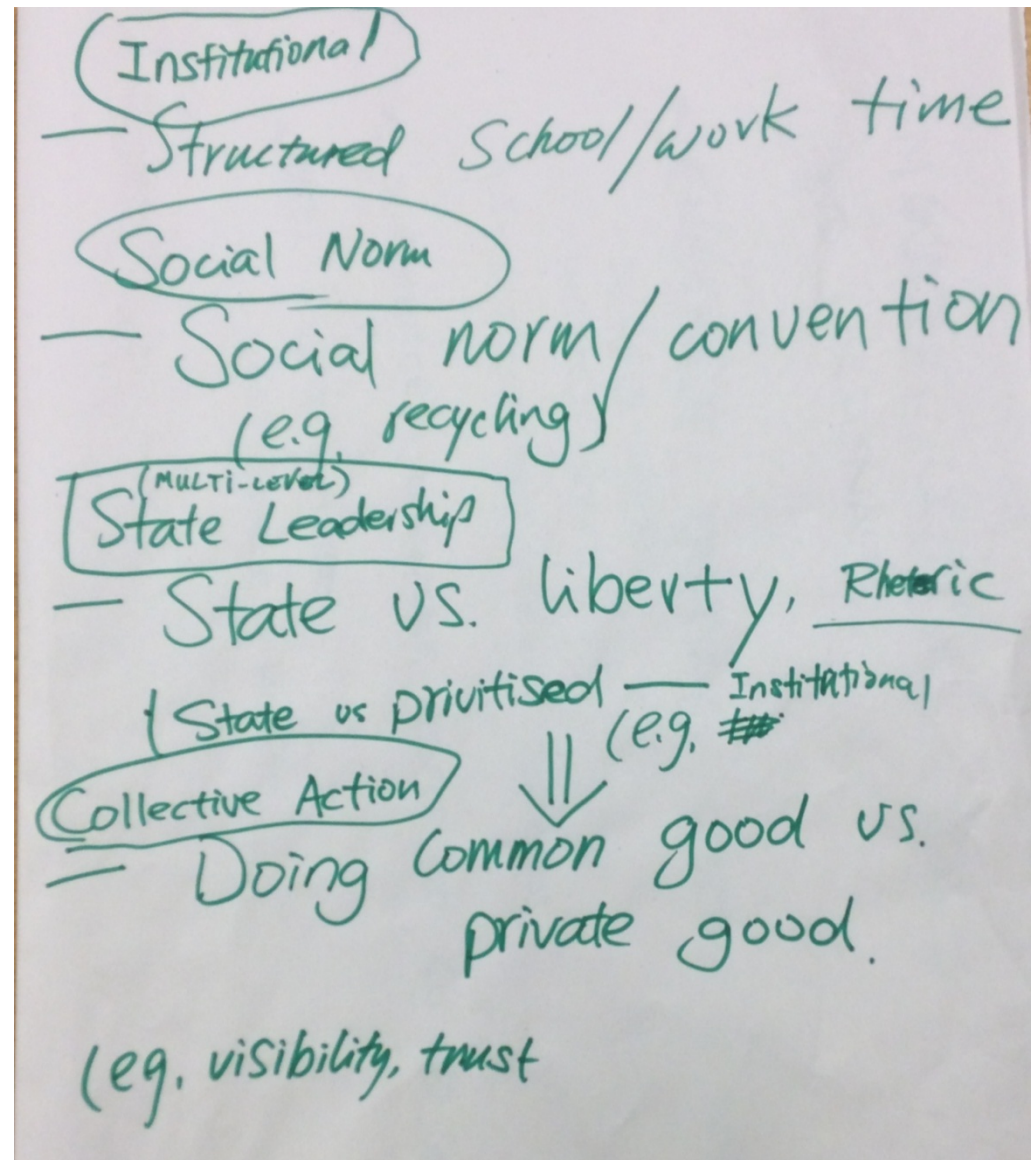
→ household level

→ local consumption of eg wind

(*) Thinking through non-market actions → legislative / institutional structures

MEDIA LAWS →

Key challenges



Key challenges

①

3 challenges

- Work & school routines
 - very synchronised
 - obdurate + hard to change
 - synchronicity is actually good in some ways! (socially, & in terms of convenience)
- Proliferation of appliances (despite better efficiency)
 - driven by consumerism, never questioned
 - linked to shift in communication habits
- Achieving change in daily routines (not just as a "one-off" event) - responsiveness + resilience
- Rebounds, interconnections, unintended consequences - demand cut in one place/time pops up somewhere else!

Key responses

(1) Responses

Challenge 1: Achieving change in daily routine.

→ information campaigns of healthy / meat free diet to stop reduce tumble drier use + promote (but backlash - 'right to dry' in USA)

(2) alternative products → clothes horses / lines outside or others to make clear benefit to consumers. + explain the problem. it addresses eg critical loads the picture a public problem e.g. water market a true empowering message empowering individuals to find their own solutions

Challenge city vs rural lifestyles + time pressures

(1) What challenge are we trying to solve?

- winter peak Fridays? More regularly.
- A low carbon network (link to extreme weather).
- could Ngen promote greater awareness of energy use.

(3) All companies operate core hours

School timings staggered but who organises child care organisation

11:25-11:45am: Responding to key challenges

Report back on suggested strategies, approaches, responses



= 5 mins per group

Intervention: SocketSaver

Each socket was only on for one out of every two hours.
At any given time, half the sockets provided no power.

Rolling blackouts

“[A] shutdown where electricity delivery is stopped for non-overlapping periods of time over different parts of the distribution region.”



Reflecting on SocketSaver

It was unadvertised. How did we find out about it?

How did we respond or adapt?

Any increase or decrease in local demand? (i.e. in the workshop room)

How did demand shift outside the workshop, in time and space?

Interventions summary

Our intervention	Traditional demand management interventions
Drink time-of-use charging	TOU pricing
Incentivised community reduction scheme	Consumption/ social feedback (in-home displays, phone aps and website portals), targets and incentives.
Cool Uni	(Dysfunctional) automated heating and cooling of buildings and homes; direct load control of heating/cooling technologies.
SocketSaver	Rolling blackouts. Direct load control of home appliances

11:45-12:30pm: Reflection on the interventions

Open group discussion about the experiments:

- Reflections, thoughts, surprises?
- How relevant and realistic are these approaches for households?
- How do these approaches relate to others we have discussed during the workshop?



Some observations

Drink TOU open rebellion in the morning break

No one has plugged anything in today

Organiser guilt about some interventions
(particularly Cool Uni)



Intervention: Incentivised Community Reduction Scheme

Objective: Reduce our workshop's electricity and data demand by at least 20%

	Wednesday actual	Thursday maximum	Thursday actual
Electricity	2235 watt-hours	1788 watt-hours	440 watt-hours
Wifi data	1632 megabytes	1306 megabytes	541 megabytes

Keeping in mind the following facts:

- The display is lower power. Screen yesterday: 330 W, projector today: 180 W
- Shorter duration of measurement: 4.2 hours yesterday, 2.75 hours today.

Success! Cake!

Shifting Routines, Changing Demand

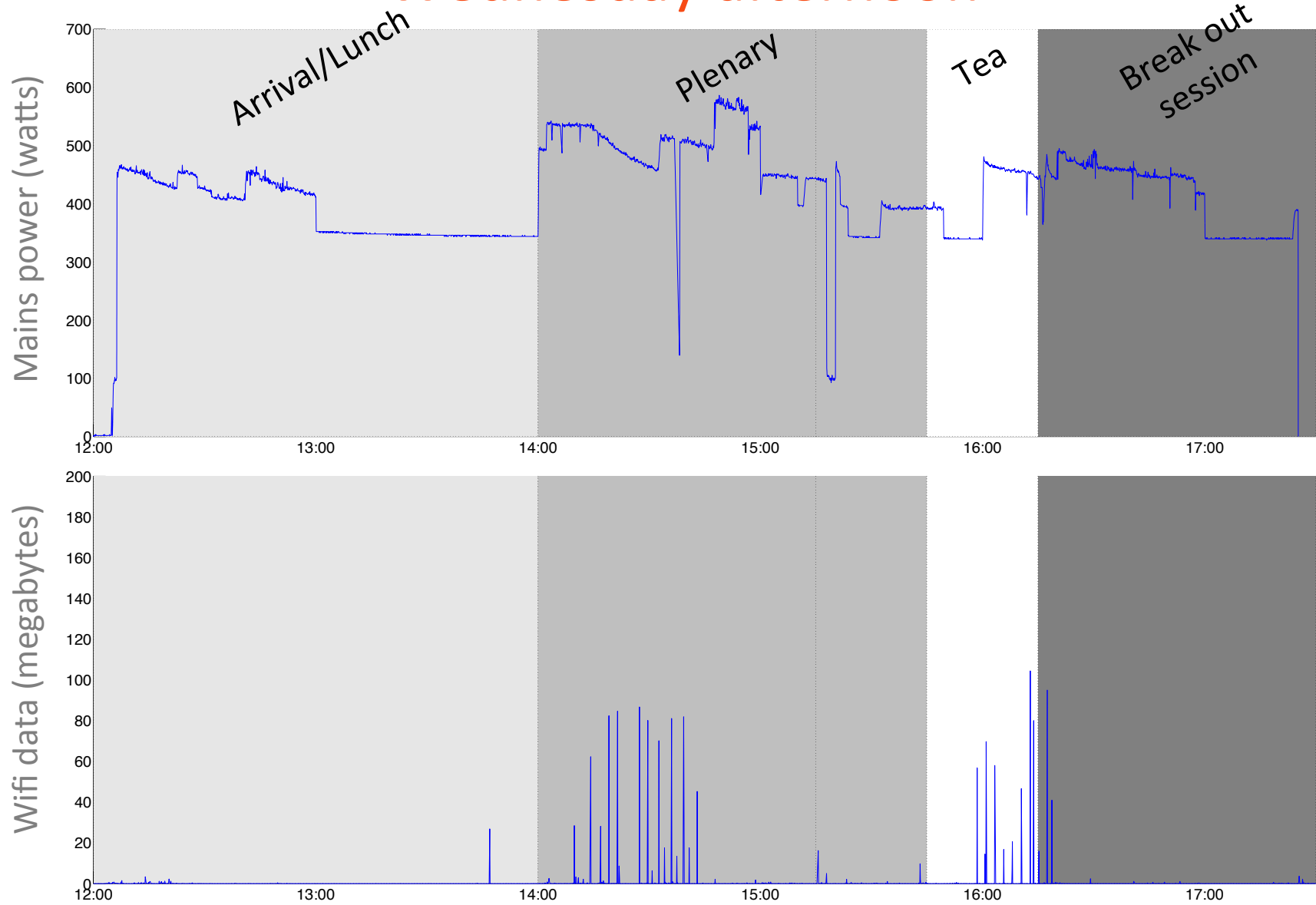
Electrical energy and data demand at the workshop

Some notes to help with interpretation of the graphs:

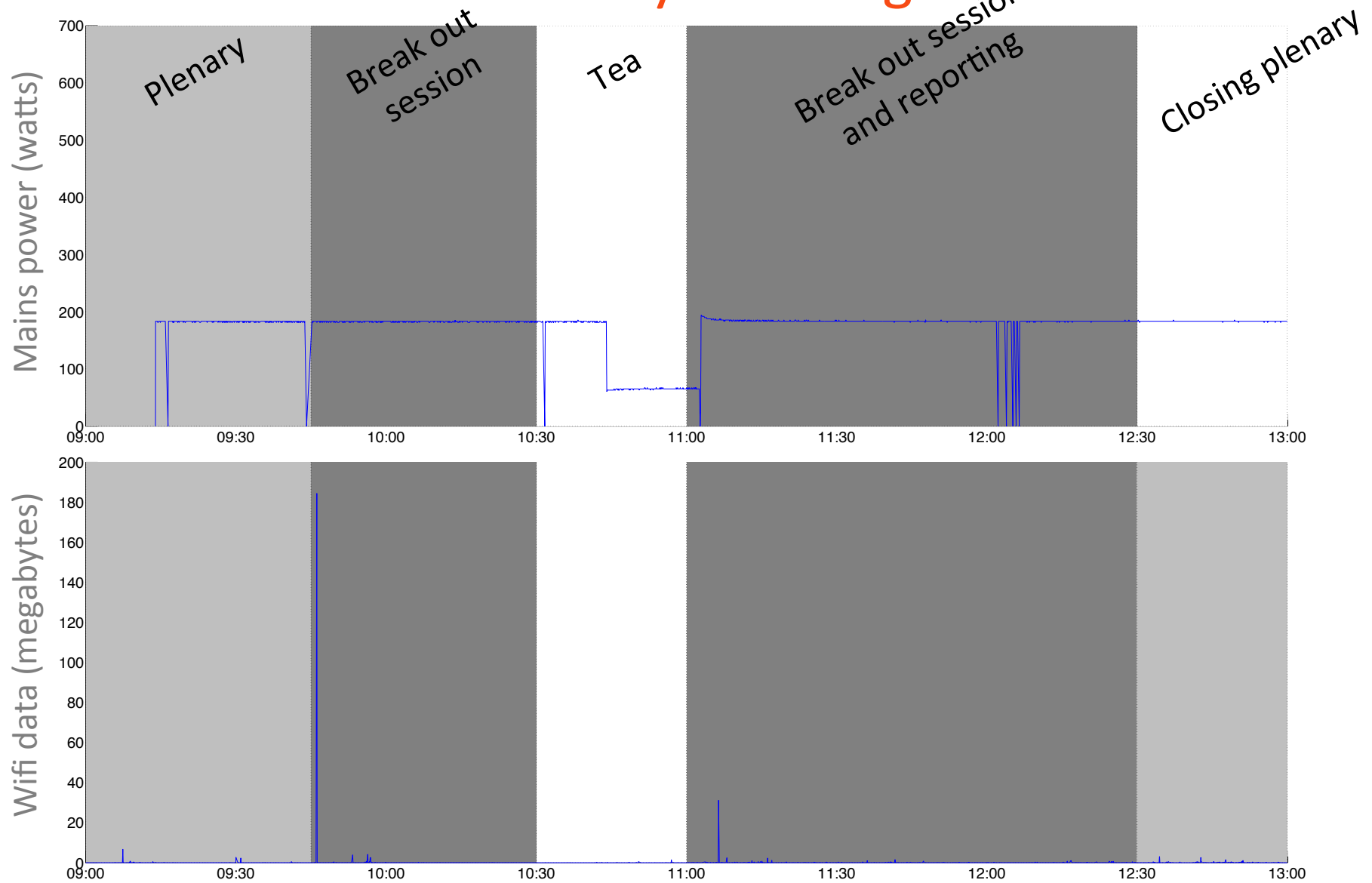
- Mains sockets were monitored with “Plugwise” sensors; wifi data was counted using “OpenFlow”
- Displays caused the baseload visible in the mains power: Wednesday’s screen (330 W) and Thursday’s projector (180 W)
- Laptop and phone chargers were plugged into sockets on Wednesday
- Steps up/down of the mains power, at the top of the hour, were caused by our “SocketSaver” intervention (rolling blackouts)
- On Thursday there was much less mains and wifi activity, mostly because of efforts at reduction to meet the target set in the “Incentivised Community Reduction Scheme”

Credit for graphs and analysis goes to Oliver Bates, the workshop’s Interventions Chair

Wednesday afternoon



Thursday morning



12:30-1pm: Wrap-up, next steps

What have we learnt?

What do we still need to know?

What should we do next?

Do we get cake?



Everyone = 1 minute