F: This is an installation of a solar panel of around 4.8 kW (a little bit more) and it’s based on [charity name] data but it is not actually the real values but the curve is actually true from June 12th. So you have here the night and then at 4am the sun is starting and these are half an hour blocks and it produces much more energy, then there are a few clouds here and that is how it works out for the rest of the day. What I was hoping we could do in the beginning is us the blocks that you have there and place them on the timeline the activities that you have annotated there. So, I didn’t print out all your annotations, I chose one day that seemed quite busy and in some cases I merged two days together, so as to recreate a semi busy day for everyone. Step one lets place the annotations on the map together. If you don’t remember what time these (activities) were, we have these [excel cut-outs of activities are handed out]. This is your own information.

H4: The times are [?] because I’ve got strange teatime. A cup of tea X in the morning.

H1: I had a really early cup of tea that morning – it is 5am for me.

H4: That’s not right – but it might be. Alright so let’s place them on?

F: Some of them are a little bit hard to see

H5: They are yes [trying to read the red block she is holding].

H4: So we are going to use these tiles [pointing to the blocks] on here?

F: Exactly

H4: H5: OK

F: You can stand up if you want

H4: So that way or horizontally?

F: I should have explained this part. The width is the duration, and the height is the actual consumption, the power. So that the area is the consumption it is kWhs.

F: So this one is like this.. [changing orientation].

H4: Oh Ok, the writing is a clue.

F: yes.

F: If you want I can cut it.

H5: It’s not boxed.

F: its quite tiny that is why it was hard to box.

H5: it is! Let me just see if I can fold it. That is going to look very ridiculous.. And same for that one [referring to another non-boxed printed annotation].

H5: So I was really baffled [ pointing at the excel sheet], I noticed that there were some quite chunky peaks of things, at times when I was fast asleep. Now whether that was my fridge working overtime I don’t know. But when I looked at the data, it was picking up some peaks and I just could not work it out.

F: It was not a fan or you charging something?

H5: Nope I never charge anything overnight.

F2: If your consumption is generally low then the fridge could be because the peaks are…

H4: Its ???

H1: It s truth, this is exactly what we are looking at. This is truth..

H4: Electric car, that’s what you were doing. I thought it was a big cup of tea.

F2: Those two are unlikely to spike. The only thing that could spike is do you have anything like a box like a sky any sort of TV related thing?

H5: nope. Its all switched off at night.

F1: These are also not very high peaks they are 0.08KW.

F2: Yes but they may look big compared to others.

H5: it is just weird because it was early in the morning and I know I was fast asleep.

F2: yes, of those a fridge would be the most likely.

H5: So is it like so [showing the block horizontally].

F1: no it is the other way. Look at how it is written.

H5: Oh ok, then I have to push the other one up then.

H5: [to herself] over and toaster 7 o clock. Oh, I’m not on there [underneath the curve].

H4: The yellow one there is interesting because we went out to cinema then. So that is the house with nobody in.

F1: really?

H4: yes. We went to see I don’t remember what now.

RPW: What is it? The TV?

H4: No it is.. our house uses about 80Watts on its own which is quite a lot. I haven’t tracked down from where it is.

F2: I wouldn’t think of this as a high value.

H4: that’s including the fridge, freezer obviously. I’ve got 11 PIR sensors altogether each take a couple of watts. The surprise is I have an electric carridge drawer machine that’s just humming away, I think that’s about 8 watts. Similarly the fridge freezer is using 8watts when it is doing nothing.

F2: Yes, the fridge freezer I would think of those are the highest. Again to you have a satellite box, like sky or whatever?

H4: no we have an internet router (?) which together it is 7 or 8 watts.

F2: yes the router is quite small normally. So would you say that the baseline was the most surprising thing? Or was it surprising?

H4: well I happened to do this experiment on my own in January. Separately. My meter flashes every watt hour so I set up an Arduino to measure the time between the flashes.

F2: and then you plotted it over time.

H4: oh yeah, I did all kinds of things. I’ve got some graphs here do you want to see them?

F2: yes definitely. I would be curious to see at the end.

F1: You also compared how well our system worked right?

H4: yes, yes that was interesting.

F1: Ok so this is your shared consumption use. Is there some patterns that you notice about yourselves or about the others?

H5: [pointing to the electric vehicle] that is awe inspiring huge.. and very expensive looking.

H1: it depends on what you are comparing it to of course.

H5: [reading the block] oh charging the car.

F2: so that could be oil instead right?

H4: do you have PV panels in your roof?

H1: no

H5: but that’s.. I have no idea what consumption a car takes but that looks a lot. I don’t know how much that gives you..

H2: [at the same time] that’s 2kW for 2 hours that’s 4kWhs. So that’s £1.20.

H1: The numbers are really small. I mean I don’t do a lot of miles. And all of my driving is around town, probably at 20miles per hour. I work as a gardener so that is why I am travelling very slow and not very far. So, for me it is brilliant.

H4: So, wait a second, you went to garden, and you powered it off one of your neighbour’s houses! Is that the gist of it? Cunning!

H1: No but I tell you what. Participating in this has made me more likely to charge the car in the middle of the day than I usually would.

F1: So, did you change this specific one to be in the middle of the day because of this research?

H1: I don’t know. No. It is just something that I have been thinking about. I have been thinking about why would we be doing the washing in the evening? Why wouldn’t we be doing it during the day if you have that flexibility because you have renewables untapped to do that.

H4: Well, I got the washing machine over there [pointing at the block] or is it a dishwasher which we timed to be overnight cause that is what you are always told to do. But really you could do it at any time of day.

H5: Why would you be told to do it overnight?

H4: Well historically, that’s when electricity is cheapest because we aren’t making cups of tea or cooking chickens or whatever. But that may or may not still be true.

RPW: no I think it still is after 7pm or something.

H1: It depends on the tariff mine is a single tariff.

H4: We’re supposed to be eating. Usually there should be a big peak right here [pointing at the 7pm on the graph].

H1: On coronation street.

H4: Right before coronation street. But we haven’t got any meals. Partly it is summertime so we are not eating much.

H5: I said this, I felt it was a really atypical period for me. For me it was really atypical because I was hardly cooking, I was having cold showers I was not even bothering to dry my hair or do any ironing anything like that. I was just .. pff.. no

H4: Gas hobs, gas water nowadays.

RPW: You did this [the tracking] during this past week?

H5: Yes, the ‘one’, the hottest.

F2: Right through the heatwave.

RPW: we were trying not to use anything electric because just the light causes some heat.

H1: I think it is interesting that the bulk, obviously it is hugely inflated by me charging my van, but it is interesting that the peak of our consumption is in the middle of the day. I would have expected highs in the morning and the evening and a dip in the middle of the day. But even taking out my van, we still have a peak in the middle of the day.

H4: I was mowing my lawn that morning because it was going to be hot later on. And it didn’t want to be under all the heat. I would usually mow it in the afternoon (but not used to being?) it really hot. And that doesn’t happen very often because it is not growing much at the moment. Mostly I am just picking up dead grass. And there are two lawn mowers because there should be a cup of tea in between [pointing at the yellow blocks].

H5: The kettles are really uhm..

H4: Oh yeah, most of my data is really: 6 o’clock cup of tea, 8 o’clock cup of coffee. Some coffees too.

F2: Are these cups of coffee or there's something more?

H4: No, that's that's my kettle. That's post lunch. Coffee, isn't it? You see how fast one have lunch?

F2: Are these cups of coffee or are they something more specific ?

H4: No, that's that's my kettle. That's post lunch. Coffee, isn't it? You see half past one: have lunch, have a cup of coffee. We're missing the cup of tea in the afternoon.

F1: What are you saying? That you were surprised about them.

H5: yes about just how much power they take?

H4: Actually, this block here cost me… That cost 15p that block roughly, OK, so it's still cheaper, than going to Starbucks.

F2: Yeah, but I was. I'm bit. I'm slightly surprised about how big are the kettles.

F1: I actually checked this correct it is not just artefacts.

H1: they are big drains, aren't they?

H4: Yeah, yeah.

H5: But even when I only fill it like 1 cup worth, it still seems too..

F1: yes, it’s a lot of power.

H4: The are very thin these spikes for a kettle they last two or three minutes. So my my kettles as tall as this one [pointing another block], but for two or three minutes not two hours.

Have you tried putting cups of tea on your battery?

H1: Not yet.

F2: Yeah, that's a good question there. Is your car also used like.. did you ever take energy from your car?

H1: No, there's no. There's no battery to grid capacity on the one that I have.   
It's a Nissan. It’s like a Little black taxi. The electric taxis.

F1: So, what do you see now in terms of like collectively, you see your individual patterns and they're actually quite different?

There are normal ones there are like some special events that are very specific for individuals, but if you would see this as a as a group of neighbors that are planning to get a solar panel, how how? How can you read this, let's say?

H5: OK, so for purely selfish point of view I would be thinking about the impact on me and my neighbors, if I was doing noisy laundry in the middle of the night because the level of noise insulation, sound insulation between properties and between doors and ceilings and floors, is not great. So I can see the logic [of dishwasher in the middle of the night] but that might be a very annoying thing,

H1: But when we've got the power that's imagine that, you know, we were close by and I we're sharing these panels where we've got capacity is in the middle of the day. So obviously you can't watch Coronation Street… well can actually well, why are you not watching coronation street at this time of the day?

H4: I always wanted a television screen that would switch itself off when coronation street started.

H1: What's striking to me is how much capacity there is.

H5: So there are some things that are more practical, like cooking a meal that you want to stay hot and then eat while it's hot and some things that could be just time shifted. Umm, where it it really isn't significant and. You know, it's not material, is it? It's or it just might involve a a change in the way that you think about things.

H4: You know in my case, that's the dishwasher, the washing machine the tumble drier possibly if it is wintertime. Then that needs (?) to follow straight off the washing machine. Rest of it is I can't shift meals that far, cups of tea are sacred times.

F1: So if you are going to shift this. Well do you know what shifting means? More or less? It's the idea of shifting with is like you take your activities and change them during the day in order to be able to be underneath the curve. Which of these activities do you think you can be shift with? As you said, the Coronation Street probably is not.

F2: or the cups of tea.

F1: Would you be willing to put your dishwasher for sure in another hour?

H4: Ohh yes, that's already set on a timer to run it at 1 o’clock for whatever reason. We can let it play pretty much whenever.

H5: I guess it also depends on what sort of lifestyle you know if you're a working person, or if you've got commitments, or how many people like you say on the Questionnaire how many people are being accommodated and lives lived within this [pointing to the curve]?

H5: So is this pattern is this power generation happening typical for almost like the longest day or the longest.

F1: Yeah, exactly. This is like a very sunny, quite, quite sunny today. So it starts at 4:00 AM and it starts at.

H5: So, you know, if it was not getting light until 8:00 in the morning, in the darkest winter, and then only going till 3. That's gonna be a very different picture..

F1: and that's exactly the picture.

H1, H4, H5: Ohh. you knew it.

F1: So in this case think you wouldn't be shifting that anymore of the dishwasher?

H4: The dishwasher would change.

F1: OK. And the other things would stay more or less the same?

H5: OK, I could do any. I mean, washing could be anytime, but it's better in the morning so that I can hang it out all afternoon. Hang it out for 15 minutes to dry.

F1: Right.

F2: What about the ones in the evening

H5: my TV?!

H4: No the oven and toaster.

H5: Ohh well that was my.., that was cooking, that was cooking.

H4: So one day, obviously you couldn't have a big meal. Middle of the day, couldn't you? Unless you're working.

H5: Not if you've got people coming round.

H4: Ohh. A special event we don't have friends so it doesn’t worry us.

F2: So that that's the interesting example is something that cannot really be moved.

F1: OK. So take your and we can try the March. [shifting the graph]

So here you have.

H4: Same scale?

F1: Yes, same scale. Exactly the same thing, but instead of a June day, it's a March day.

Which is not a bad March day. It's still pretty sunny at some points, but you can see there are intermittent clouds here, so it's not as ideal.

F2: But it's not the winter solstice, so there's still some actual generation.

F1: And if we put back our data.

H4: Put your big one back first.

H1: Well, I feel that we shouldn't put it back.

F1: Why do you feel?

H1: Well, I suppose you know, putting myself in this situation where we are sharing these panels in in, in the summer, I would definitely be plugging that in middle of the day definitely. But in the winter I'd go and plug it into a lamppost charger and charge it overnight somewhere else. I would. I'd make a different decision because we're playing with different resources.

H4: I think that's I think, quite slowly, two kilowatts. So that's quite a slow charge.

H1: Yes, it's just, it's just coming up with 30 amps.

H4: OK

F2: How does it work with lampposts? I'm not familiar with that.

H1: There's an app. You just a QR code. Scan the QR code, hand over your credit card, or you'd Apple Pay it, and when it starts to charge it locks the cable in place, and then you're there until you're charged. Then you get a ping. When it's done, you go get it.

H4: So my house is using more when I’m out than your TV [comparing blocks].

Cups of tea..

H5: So washing 7:30. I'm just gonna put you up [moving her block underneath another one existing on the curve]. Showers.

H1: I Feel like I'm not gonna have the air cooling on in march.

H5: I mean and then we should wish strange little the little question, the little question marks. Yeah, 4:30 and. Three o'clock strange, [talking to self]

F1: I'm especially interested about the siding that you're not going to charge the car.

Because in a way we see now, there is still some unused solar right.

H1: Yeah, yeah. Absolutely. No. My first thought is ‘no, stop it’. But yeah, it's.

H5: But it for car is a vehicle in electric vehicles plugged in. How does it work? Does one device take priority and then lock all the others out?

H4: You can get smart charges, that check whether you are exporting electricity to the grid agreed and if you're exporting to the grid they turn, start charging the car instead.

H1: they divert it so it just takes the surplus. So there, there, there, there are smart gadgets to do that and that's what we're talking about here is straight solar, isn't it? Rather than solar plus storage.

F1: Exactly, exactly becomes the next part. That's good that you answer it.In this case, would you not try to? I mean try to shift?

H5: because there's no generation there is like,

H4: Move that washing machine [it is a dishwasher].. So that could go anywhere

H5: Ok so that could plonk somewhere.

F1: But you had in your comments that you need them ready for morning.

H4: Well it can be planned better. Yeah. It's just sometimes cause maybe two of us in the house. Now. The lot of dishwasher. It takes a long time to fill up. And then somewhere there's nothing for breakfast next morning. I could always think ahead and count slightly earlier, yeah.

F1: And you still think that in this case you will not put the electric charge?

H1: No, I mean now. Because it it would depend on what your protocols were for energy use I suppose. But if if it could be navigated so that the because it's obviously better to use your solar than to export your solar. So yeah, I mean definitely just, you know, consider it consider it in there [placing the block back].

F1: Why is it always better?

H1: Uh. Because because. You, you, you get a very poor payback on on exported. Uh energy, whereas you're paying $0.28 per kWh. Yeah, for for the alternatives. So. So it makes sense.

F1: Like, economically it makes sense?

H1: Yes

OK. So then in this case, let's say you have this kind of shifting situation. The idea would be here. So if you are actually neighbors and you actually share this kind of PV with you, how would you coordinate do you think amongst yourselves to share this kind of PV? Can you imagine yourselves like, how in real life like this is like a? A scenario that is a bit fictional, but imagine during your daily life and you want to use this activities like this and make the most out of your PV.

H4: Do you want me device talk to each other. So you set me up, you know, to run this machine today. Chat amongst each other.

F1: The devices or the people?

H4: well, I would say that I want my dishwasher to run today, OK. I think and then divided with chat amongst each other have to chat amongst other to decide who goes first.

I mean this is wrong. This dishwasher shown us that actually it's a peak here, a very High Peak here. Actually, it's a two kilowatt peak, followed by two hours doing nothing but another two kilowatt peak, with essentially nothing in between. All the whooshing noises and so on there is essentially no power. So you could even if you waited for this one to do it first heat up then someone else could start the other machine just after that. [it] Wouldn't actually have to be waiting till that finished. You can start about here as long as the peaks don't. So it's actually more subtle than just saying Ill place my dishwasher here and then other there [placing boxes next to each other]. It's quite tricky you need smart devices

That know how much they're going to use and chat to each other about it.

H5: And they don't exist?

H4: No, no.

H1: Umm but but with some.. so people who have solar have seen this on Twitter, so I know it's true. They have, they they have readout things that show their generation that exporting to the grid and to the electric car and battery and and so on. But if if we 3 all had a sort of iPad app that we could look at and say, oh, look, generation high consumption, low .. ‘quick put the dishwasher on’

H4: If I did just see the same thing same time then we’re in trouble and it's gonna be a bit of a fact to do, surely this has got to be...

H1: Yeah, but but then you then we're waiting for the perfect world to come along with all of the all of the right devices and all of the right, all the right tech,

H4: In my view its on two or three devices the washing machine the dishwasher that actually, this applies to. I need to replace those two,

F1: but in this case we already know what the day looks like, right? We have a perfect forecast and we're doing this in hindsight that this dishwasher should go there because of that reason. But the reality was the day comes along. It's not like you necessarily you can have some forecasts, but you don't have that specific like sunshine moment that the clouds pass on top of your actual house, right. So there has to be some kind of maybe immediate coordination amongst yourselves or even more daily coordination, right?

H5: We need to know the forecast. Yeah. Don't we have some of the forecast?

F2: The forecast is in this case almost literally the weather forecast, right? Because it's basically how cloudy or sunny is it going to be? Yeah. And we know that that's not always correct but.. It's the best.

H1: Umm. And how much difference does does that make? I mean, so this is a moderately sunny day in March.

H5: It's a very sunny day.

You know what's peak? That was straight sunshine. OK. No clouds.

H1: What about a dull day? I mean, are we talking no generation, or are we talking in the year somewhere like here? [pointing] So sub 2 kilos.

H5: Yeah, and this, could you really start hitting up against people's lifestyle choices, which can then create all sorts of dynamics around people who want to tread very lightly on their planet and the consumption and others think, well, that's fine, you know, because, you know, we've we've got XY and Z to go on and you know why should? Why should we change the way that we live? It's tough. It's really tough, isn't it? Because. You know, not everybody can just change at the drop of the hat when the sun comes out.

H1: But could it be that you have a sort of supply contract? So I think at the moment we're playing something like 24 pence per kWh, something of something of that order. But we could have, we could all have a supply contract so that it was coming to us at 17 pence per kWh. All of us, everything that we use and some of that will be taking from here. But some of that will we will be drawing from the grid. Yeah. And so it doesn't really matter.

That much you would you would try and and and and use as much of your own local power as you could. You would look at the app and all the rest of it, but it wouldn't cost me if you were running your dishwasher at a particular point, it wouldn't. It would cause me no pain, I might think Oh, enviromentally, that's very.., yeah. But. But. But it wouldn't. It wouldn't cause me any pain.

H5: But I'm interested. I don't. I don't understand the logistics, the technical side of how it would affect different people and being able to connect with the shared resource ofthe generation with what happens to get it into our three homes

F1: So the way you would go here is that imagine that if something that comes out of the outside of the time of the solar, it doesn't mean that this person is going to pay that, it means that this price, this extra let's say cost will be divided amongst the three of you. So then it's on everybody's benefit that you actually shift. That you actually managed to be on the underneath the curve because then it's not, it doesn't separate. It's just like a total consumption and will be mining between amongst yourselves.

H4: All the good people resent the bad people. Yeah, just do it anyway.

H5: Because for the bad people there's no, there's no, there's no bad people. There's no. Yeah, there's no comeback, is there? No.

F1: Who are The bad people, sorry?

H4: For those who just turn their dishwashers on here and washing machines or are just

H5: thoughtless.

F1: Amongst you three, which are three neighbors, let's say who have decided to do it like this thing. we are assuming you're not bad people, right? Would you, uh, imagine, for instance, that you say whoever comes for what I'm understanding now, what you're saying is that the device is an algorithm should kind of decide which device goes when. And then that amongst yourselves, you would say first come first serve whoever needs it, whenever they needed, they will use it. This is what you're saying. There is also other ways, right? They could be that you say you run your fridge, your fridge no, your laundry on Fridays. I run mine on Tuesday or something like that. Yeah, there are other ways of coordination.

H1: Yeah, I I think I think what you're saying, I can definitely see that, and I'm making, forgive me some assumptions about the ages of the people around this table to think that we may be have much more flexibility in our lives than other families might have. So. So if we three neighbors sign up to this cunning plan, I think we could make it work. But, Umm, if amongst us was a family with. Lots of young children who are out in the middle of the day but had high energy needs at I at either end of the day. Families that had less efficient devices, so that just not because they're bad or callous, but they are just using more energy to achieve the same work, because that's the infrastructure that may they've got, then that becomes more difficult I think.

F1: So first come first serve. For your system,

H1: we could work it together. Yeah, I think, yes, we could I mean this splitting the laundry

H4: This interesting because we've always done the laundry, but it needs to be sunny. We don't want the laundry when the weatherman says [inaudible].

H1: Then we are not washing in March are we? We are saving it for the end of April.

H4: I don’t have that many socks.

F1: OK.

H4: The problem is if you do the eco wash five hours now in our machine so you kick it off at 8:00 in the morning. It's not going to be out until after one.

H5: So you are noisy neighbors with all the noise of the spinning machines, OK?

H4: Im detached its OK.

H5: good.

F1: Can you imagine running something like this with your real neighbors, like coordinating with your real neighbors?

H5: Absolutely not. Under no circumstances. In a flat, relationships are not always they, they may change. So you might have turnover of neighbours and people who are away some of the time. People who don't get on some of the time and.

F1: And so in your current setting, you cannot imagine.

H5: Umm. I wouldn't say never, but I think it's hard to envisage because again people have very different lifestyles and some people might be running like lots of games

H4: but games are and quite small power consumption they won't appear on this right so.

H5: But they may have different limestyless, you know, they may like 3 showers and baths a day.

H1: I think that's an interesting point. You mentioning showering and building because that doesn't show up on our consumption because all of our water is heated by gas. So that's that's another consideration when when you look at .. because obviously the energy to heat water is a massive thing.

H5: But mine went up, mine is gas, but it's got a pump. [pointing to find their showers] OK, OK. So it's a little one.

H4: It is half the thickness of my watt when Im not at home.

H1: Yeah, mine doesn't have pump. It just comes, it just comes out of tap. Umm possibly not with as much vigour as yours .. but that's another sort of comparison between different households and.

F2: You would you consider replacing the water heating to something electric in this case? H1: Yeah, definitely.

H5: Umm, I mean, that's an interesting thought, you know, particularly because there's upcoming changes to what you can do with gas boilers.

H4: heat pumps will cover them eventually.

H5: Well, I understood that gas boilers were going to be phased out phase,

H1: by not putting them into new dwellings.

H4: In seven years time

H5: I've stayed somewhere with a heat pump. Yes, and it was absolutely wonderful. I loved it, to bits

F1: Why?

H5: It was in a very cold part of the country in the UK. But it was a new build house with really good thick insulated walls with really good glazing. It had underfloor heating installed from the heat pump and we never needed for any kind of.. I mean you walk in. It was a cold day, it was wonderful. And that was a new build. It was just wonderful.

H4: 2-3 years ago I did the experiment running the hot water off the immersion (?) heater over the summer rather than gas and it is more efficient because the [?] are efficient but it costs the same. And it's slightly worse to use, you know, of pool of scolding waters off the tank, which comes out first and catches you unaware whereas from the gas it is much more uniform. But the cost was the same.

F2: OK. So I guess it will be a different story if instead you had a PV panel installed.

H4: If I had a PV I would obviously introduce that .

F1: Should we introduce the battery?

F2: I think so.

F1: So now you have the same system, but now I'm gonna also show you a visualization here. So this is actually your own consumption here the day. This is the day from June, not from March where you would see that like the yellows, the Reds, the electric vehicle and everything, and here you you have like how much solar has been generated and how much has been used from it directly and how much have the be consumed from the grid in this case because for instance in the middle of the night here there was no sunshine, right. That we're assuming that there's no battery. So then this immediately has to go from the from the grid. And when we start at increasing about putting a battery. Then you can see how slowly. There reaches a point which is quite a small battery you would need in order to be able to to get them as much as possible.

F2: And you want to also talk to the Gray box, the export

F1: This is the unused. The things that will return back to the grid, this is unused solar. So how would that make you feel about getting a a battery? Do you think that it's worth it?

Would it change your coordinations you think?

H5: so you can store it and then draw down on it at a different time of day,

F1: Exactly. So these things here, the activities in the evening which are currently outside of the of the direct sunlight would be actually drawn from the from the battery.

H4: ??

H1: Well, yeah. It's got a 24 kilowatt battery, so I could do way yeah. Just leave your electricity with me. We'll sell it back to you. Yes, OK.

H5: So if you still want pound consumed, how far does the battery have to go to get rid of the power consumed? Can you?

F1: It will never go because of this.

F2: Because we are not considering one day to the next, it's just the one, OK, we are assuming that you buying it today. Yes, you're buying the battery on this day, right?

So this would be always outside.

H4: The trouble with the battery is that it's it's expensive to install. So better off people can buy them all, the less well off can't. It's the better off people will benefit from having cheap literacy and the worst of people who end up with more expensive electricty which goes against my.. politics.

H1: But there is no system that the middle class and the rich cannot twist to their advantage.

H4: Well, I must admit. We need town size batteries, I think.

H1: Or sand batteries.

H4: That's just heat.

H1: But the battery is just stored energy.

H4: So yes, but electricity can be used for anything. Heat can just be used for making houses hot, cups of tea. But I wonder whether electrifying the XX of about 30,000 people. We have a little I Guess guess turmoil.

H5: So that's like microgeneration, but on a big scale, yes.

F1: What about starting by the three of you?

H1: I think bringing batteries into individual homes helps to resolve the lifestyle questions. Yes, because then. You know decisions to use power at different times that reduces the impact on on other than,

H5: yeah, you can depersonalise it can't you. Yeah. And just say yeah, it's just like it's just a bit like the National Grid, but it's a bit more local.

H4: So there are going to be times when you're going to want to import power from the National Grid and the interesting to see how that gets priced as we start using the National Grid less and less. It will be locally the marginal cost of buying something from EDF. Will go up.

F1: So what about the the devices you were mentioning before, like the smart meters? Or not smart meters sorry already exists or not? Smart appliances, smart appliances, the coordination mechanisms like this app that you were imagining before. How would that then not need to exist if there's a battery in? Is that what we're?

H4: It still helps to have it there. To minimize the size of the electronics and get the power out of the battery again. To minimize, to magnify, minimize those peaks to plan the. I mean in my January thing I got a five and a half kilowatt peak from my house lasting for six seconds uh, when I guess the microwave, the kettle and the other were all on. It was at 6 seconds, OK.

F1: Umm, would you be OK for instance with these appliances to decide that your laundry should run at 3:00 PM, whether you like it or not, because that's when it actually balances better with other people.

H4: You probably want to put the time in saying I needed to finish by ‘whatever time’

H1: I worry about. I worry about the the the thing that you mentioned about, you know, people in close proximity. I live in a terraced house. But you know, I can hear my neighbours sneeze. So certainly like, I couldn't and wouldn't put my washing machine on before 7:00 o'clock in the morning and after 9:00 o'clock at night. Don't think that's OK in the dwelling that I I live in now. But I also want to worry about the kind of level of technology that we're talking about. I mean, obviously you are very invested intellectually in, in this sort of exercise. I'm really just kind of want to plug something in and it to work and want to do it in the least planet damaging sustainable way. I don't really want to sign up my washing machine to the World Wide Web. In fact I just bought a new washing machine and it just so difficult to buy one that wasn't web enabled. What's that about?

H5: But maybe they'll be other ways that are more low, low tech, you know, like maybe clipping something onto each device. So that you could see what consumption is from that device. I'm a bit like you. I I really do not want to share with the world and the web any.. I don't necessarily want to share with my neighbours what I do in the privacy of my own home and at what times of day I'm doing it and Umm, you know, there are certain things where it just feels a little bit too personal. Uhm, you know the business. This. Yeah, and I don't want to know what they do.

H1: Yes.

H5: If Im honest. But I I think flipping it, the other one like you were saying, you know we all you know in a big city and I I would I would mean I would be more comfortable If I felt that there were ways of making properties insulated so that we're actually reducing the demand and our consumption at the very start point rather than thinking about ways that we could distribute the scarce resource that we're generating because here we're not.

H4: But here we are talking about things that are affected by insulation, not heating.

Where are you talking about glasses in the house aren’t we?

H5: Or might be in the winter. Well, OK, here. Yes, yes, but I'm just taking a step back to March.

F1: So am I understanding correctly that you're against the coordination and the first place? That better to have a battery so that it can solve our individual differences? And then we don’t need to speak to each other. We don't need to coordinate it anyway..?

H5: It feels a bit more neutral. Maybe that's the way of framing it for me that it's more neutral. Umm, you know, it gets away from that terribly British kind of thing.

H1: I think I shared some of your your concerns I also just think it's more inclusive if we can have so, so we could easily agree really washing Mondays or Tuesdays, Wednesdays and Thursdays, Fridays and Saturdays. So. So we can. You can have those kind of rules and that could work for kind of maybe any kind of household. But to have less of that to touring and throwing about the micro consumption feels a bit more inclusive, so that different sorts of households could participate. umm, without having to be massively we, we are already obviously massively committed to these ideas because we're here now. Not everybody feels that way. And if I think about applying this to my house and my neighbors, you know, the housing association flats on one side, private rented flats on the other side was quite a high turnover. Nobody's buying into this. Yeah, it would have to be a sort of plug and play solution for it to have any chance of success, that's it.

F2: Sorry. Just make sure I understand correctly. So the sort of like days of the week, you think of as a plug and play solution to a certain extent,

H1: yeah, yeah. I somebody, even though they're only allowed to do their washing on a Wednesday and Thursday, is going to run and cycle on the Saturday morning. Yeah, without a doubt. Yeah. But you can have rules of thumb. And I think that that would be OK.

F2: Yeah.

H5: It's kind of it's just sparked a thought because some friends of mine who live in Germany. Would say you know when they're in shared. Not shared flats, but where there's flats that you know there are several of them, you know and they are very used to. I am quite stringent rules around who does what you know, like who has to sweep the snow in winter, on which particular day and and that was a real shock to me that that should even be something they took us. Given it, it was just a little the way they do things in Germany, much more used to having those rules.

H4: In islands off Scotland, one of the outer inner ??.   
Where they've been trying to minimize the use of diesel generator and the idea is seen various TV programs of the average housewives saying all right [?] can go on now because I've got this meter on the wall that says I was below two kilowatts. So individual people, a small community bought into the idea of limiting the peak consumption.

F2: Yeah, it's interesting how different countries have different system. When you were talking about the microwave and oven and the capital being around the same time, that's something that would definitely not happen in Italy because.

F1: it would just drop

F2: Is it the same in Greece? in Italy in most properties. You have a three kilowatt limit and if you go above 3 you have to go downstairs reset and and and turn the thing back on.

H4: We work on 24 kilowatts.

H5: I wonder if we are kind of overfocusing on I'm just trying to take a step back from this and thinking about what are the kind of things that appeal to peoples’? Not their better nature, but what money? Money is what appeals to people, isn't it? And if you could say, well, you know, if we could find a way of or working this out, we would all have a shared stake in making life easier and making life cheaper for us all. And, you know, flipping it onto a financial cell, does that help in someway?

F2: Would would would that mean for example, that you have certain days to do the laundry? And if you do, and if you do the laundry on a different day, you get you can do it, but you get a higher price?

H5: Maybe maybe. Or think of it as a discount.

Yeah, for the days that you discount, I think, yeah, you might face an unexpected high bill. Yeah. [?]

H5: But otherwise you re you re contributing to lowering everybody you know, we're all trying to lower everybody's costs.

H1: But I I suppose the kind of democratic solution to that is the battery, isn't it? Because if, if it's producing. I don't know, six kilowatts over a day and we all have batteries and we get 2 kilowatts each anymore that we personally use above 2 kilowatts comes off the comes off the break to and and I'm paying for mine and you're paying for yours.

F2: Can you remind me what's what's next?

F1: The next is the debriefing.

F2: So maybe given that we we are a bit ahead of schedule and yeah, I think we didn't mention, but this is the first time that we run this so and some of the ideas are reminding me of another project today where we had this discount idea. I'm wondering whether it would be useful even though it's completely unplanned, so stepping into improvising mode.  
to show that and and and and and. I think that that could be, yeah. That means give me a second to think about what's the easiest way to bring it up because it didn't. As I said, I was not really planning to want to show this, but it sounds seems really, really relevant to what you were describing. And also in terms of this idea of like booking laundry and. In Switzerland in in some blocks of flat washing machines are shared, so you have a washing machine in the basement and the way that they do in certain places is that you are given a day and so you're supposed to go there on a certain day. And yes, as you were saying, some people then go out of their day and obviously the weekend is more convenient for everyone and people are working. But it seems to see that there is some sort of them. In the states as well, in some cases there are only washing machines in the basement.

F1: In Finland, where I was living, it was also like this. Umm, we had a book where we have to book in our time.

H1: And did people comply?

F1: I didn't mostly.

H5: So we've got the kind of northern Europe, southern Europe,

F1: I'm not used to, I was not used and I am having to preplan my laundry like a week in advance. That was something that was very hard for me because I I didn't know when my clothes would be. I was living alone also. So it's not like I have a big load all the time, right? So.

H4: OK, my mom, with you to the washing on Mondays. So this year, don't you know? I've always thought on the week set for weeks.

H1: Yeah, Monday laundry is very old school.

F2: Is it because it's after the weekend and you have more stuff to wash?

H4: No idea. I never asked.

H1: So yeah. Yeah, I think so. You will have to make sure that your Sunday clothes

these are your best are washed and dried and ready for the next Sunday.

H5: Then they also do something very similar in some of the old tenement buildings in Glasgow and Edinburgh and they still have some of those rules about which flat may hang the washing now on the communal line in the back garden.

F1: But in reality, do you imagine yourself going into this like, uh, like in, in real life, with your real situations? Can you imagine our suddenly from tomorrow saying I'm only gonna do my laundries on Wednesdays or Fridays or whatever day is being decided?

H4: I think its too hard for working parents with kids at school and two people out all day. It's fine for us.

H1: Yeah, I mean, I I, I I don't have a very complicated life. So I think it wouldn't be a problem for me. But but like, I can, you know, if I think back yeah, 10 years where my daughter was ten years younger. And then there was lots of jam and pesto and everything everywhere. Then I would probably have the different options in the bathroom.

[F2 setting up their laptop to show a presentation Redacted for anonymity]

H5: You know, I won’t say flights because that's probably not ideal, but those kind of things where you just think OK I will look at how much it costs to travel you know is it better if I go on a Tuesday or Friday after six or .. but for those relatively low cost it feels quite intensive…

H4: A lot of work to save 50p.

H5: You know, a lot of people would just go. You know what? It's not worth it. It's not worth it. Yeah. I'm just going to do it.

H4: He's not dynamic, taking account of all it's sunnier than expected today. But I can say that in my mind, I said I’d like to have it done by 6:00 o'clock and let the Internet decide best time to fix it.

H5: What did we do that to a certain extent last week? You know, did any of us change the way that we behaved last week?

H1: Yeah, completely.

H4: I did. Because of the heat and the sun, yeah.

H1: Yeah, it rewrote my week. Completely.

Much simply involved in what way? I mean, so I would normally work Monday, Tuesday, Wednesday. I didn't work on Monday and Tuesday at all because it's the I've worked outside, so it seemed like a stupid idea. Stayed home with the curtains closed and did my tax return. That was not on my schedule this week at all. But yeah, absolutely. In response to circumstances changed everything.

F2: I dropped my kids off to school much earlier than usual. To avoid the heat

H1: Then you push them into a hot building and ran away.

F2: exactly

F1: like every parent should.

Yep. So the next yeah, I think we can move to the next part if you want. So in this part now, I was just gonna ask you some like debriefing questions kind of wrapping it up.

Umm, I guess I wanted to ask the first thing you learn something new about your own consumption or about how solar works by by participating in both in the workshop but also in the in the process of annotating all this week.

H4: I learned all my stuff back in January.

H1: Yeah. Yeah, it was the back. It was the background stuff that I found, you know that that, that, that line along the bottom. Yeah. Nobody is doing anything as far as I can see it. Only the smart meter is drawing power and that can't be right,

H4: you know, it's drawing it from the meter side so they should be OK.

H1: No I mean the little digital, the, the monitor.

H5: Yeah, I I was shocked at how much just unknown stuff was happening. And realised it must just be all those. It must be the fridge. Yeah, yeah. OK.

H4: I work out in January how bad I was.

F2: I guess the the the fridge comes back to get us to talk about the heat wave, right? Because the fridge is sensitive to how hot it is outside. So if it's the hottest day ever recorded in the country, it's more likely that we will not issue.

H5: But it was, you know, the 4:30 in the morning surge. I I I couldn't. I didn't get them at all.

F2: Well, it's probably because it's keeping ..for for the night and then when it's slowly, slowly, it gets warmer and then

H5: something kicks in?

F2: Yeah, that could be. I mean, obviously I cannot be sure without looking at the data, but that could be one explanation.

F1: And you were thinking, or at least you were interested, right? Forward small solar panels when you were signed up to this study, has that thinking changed or, you know, commented in some way or not the same?

H1: I I think thinking being forced to think about.. asked to think about.. the flexibility of my consumption has made me more inclined to think we could make solar really work. Then I've been a bit. It's obviously good for the planet. I did think ‘could work for us,’ we could be more flexible and.. yeah. It's been good in in that regard.

F1: So you were already aware that the need to shift your activities, right, so now you realize to what extent you can actually shift them.

H1: Uh, yeah, no, I don't. I I think I've just thought: look at the price of electricity. Look at the price of gas. We need to shift more to electricity. Therefore, we need to think about solar and and then then this exercise made me think about the shift business and they could definitely work.

F1: It's interesting.

H5: I I hadn't Got to that point and venting my frustrations about living in the conservation area where you're not allowed, you're prohibited from installing solar

H4: they relaxed ours. We might be able to stick them if it is not facing the road,

H5: I know. But the street side is the sunny side. And it just felt like. If only there were technologies. So that when people were reroofing, they could be hooked up to some sort of solar PV. You know if they were tiles.

H4: you can get solar roof tile now. Yeah, they don't look the same.

H5: So will they look good enough for a conservation area?

H4: There is some outfit offering the color of them as you like. But they weren't very efficient.

F1: Well, what do you say now that you are allowed to be relaxed?

H4: The I believe so, yes. I haven't investigated yet, but I read the planning the other month.. exciting and they seem to have allowed it

F1: and has this exercise helped at all in the thinking about solar or were you already aware of..? Have you already gone through the thinking process of actually installing?

H4: Uh, yes, yes, I've got both my sisters to install them, OK, because they live in places wasn't [conservation]. One of them even has a battery. [which she raves about.?]

So I've been… Previous job: Buildings engineering spacecrafts. I've always in charge of the solar arrays on the back of a spacecraft.

F2: Wow.

H4: Past Millennium sometime

[Redacted for anonymity as discussion refers to partner charity]

So now a bit more meta what do you think about the workshop and the process? Maybe like three things that you enjoyed or you liked and maybe three things that you would like to improve. you think could be improved and and the whole like research process ayou ve been through.

H4: I wasn't able to do the annotations on my phone The screen was [..inaudible] I had to get the laptop out, once a day, and therefore scraps of paper. It would have been so much nicer, if I could use my phone [..??..]. It's just me which is likely. It would have been much easier than this. I got my wife engaged, so obviously I need to work on two phones speaking same system somehow.

F1: Was she engaged?

H4: Yes, she was scribbling on pieces of paper. OK, I could read them afterwards it was OK.

F1: So you were writing little bits of paper and then you went and annotated it.

H4: Once a day or something then I sat down, and I put it on the machine.

I suppose. Often several things happen at once. They said you had like the kettle which fills in the half an hour, wasn't it? But, you know, meals for me could mean a microwave and a kettle. To going big. So this was a little bit awkward. I gave up trying to annotate the computer, because they're essentially all day these is a computer someones laptop or the telly. They are about the same, so I did not write these down. I gave up doing those tiny things, I just did the lumps that stood out.

H1: Yeah, that's a good point. Part of this is a background noise of our consumption is the electronic consumption of a 14-year-old child. Yeah. And that just kind of rumbles constant background that I suppose and I actually I what I was expecting to see peaks in the evening.

from that, but I they weren't really there. So that must mean that those devices actually don't consume that much.

H4: OK, I've got my son a computing, gaming computer and oddly enough, the power consumption you could see it on our bills, half a kilowatt, 6 hours a day, simply that counted the jump in power and you can see it, you can actually see he lost interest in it, it came back. Yes, don't get them a gaming computer.

H1: I know we weren't. We weren't doing that.

H4: The other thing I put a curfew on the on the Internet. So his internet gave out at 10:00 PM and although his 20s now, he's still goes to bed early.

H1: You're very generous our is cut off at 8:30

H4: OK, you’re already there.

H5: It made me want to have some comparative data for a colder time of year or a a less intense heats spike, and I also had the whole street’s Internet dropped out completely for about half a day and I wasn't there at the time, but I didn't know if it was affecting the monitoring. In fact, it wasn't. But it just made me a bit nervous about. Oh no, have I lost all that? I've I lost half a day. And then I realized when I got it back on the IT was fine. It was all just tugging away in the background and but I think it did raise more awareness in me about all those hidden low level little things just just tottleing about. And even I'm sort of intense about even turning off the telly and whatever, you know, the set-top box and unplugging things at night, and even just those little things.

H4: But I've measured room with the telly and DVD player in it and it's got Alexa thing and a Wi-Fi thing that's two or three watts that's on standby. It's all modern kits because of very low power and standby, it's not worth switching off 2-3 watts and afraid. Yeah, that's that's nothing.

H5: But its all power.

H4: Yeah, but it's a 330P (?). So it’s a 10th of a penny or something.

H1: But if you if you don't, if you don't think about the money, but you think about the power. so That's three times nothing is a little bit but then 65 million lots of...

H4: In my head you see Im wired that you're not meant to switch things on and off a lot because the switch on search can damage them internally, OK? It might kill your telly earlier by switching on and off. Because it has to deal with switch on search and also you'll just switch on the wall is going to have a smart and you'll switch your switch it off and a small one. But all these things in my head I worked in this area, I just all no for what? I'm going to leave it on.

H1: So you leave your telly on standby?

H4: I've measured it. It's it's meant as modern telly it should use less than a watt on standby and it does. OK, so what's going to cost me £0.30 in a in 1000 hours, isn't it? 1000 hours is a long time that's 40 days.

F1: What about the the physical parts of their data?

H1: Can I just say one more thing about the the the the interaction thing? I couldn't see an easy way to cut and paste from one activity to another activity. I just wanted to say.

Kettle for a cup of tea, microwave for hot milk 17 times a day, but instead I was typing it like this. It cannot be just my life that is so dull. But that was, I thought, a tweak that

H5: Similarly, the just the kind of blunt question, could you be flexible? I think it kind of it was it. It made me think, oh, maybe that's a little bit closed. Rather than encouraging us to think, you know, are there things are there times when we could be flexible or yeah, what could affect your flexibility

H1: and also flexible plus or minus one hour, 3 hours, yeah. Plus or minus one day.

H5: Yeah, yeah, yeah.

H1: Those are two completely different questions.

H4: Checkboxes for that would be yeah, yeah. Quick and easy, wouldn't it?

H5,H4: Yeah, yeah, yeah,

H1: Because that was. I thought for me, the most interesting thing about how flexible lots of life consumption is.

F1: And something you learned out of this process?

H1: Definitely.

F1: Ok. And what about the the physical aspects here? Do you see? Did you see that it impacted your discussion in some way?

H5: I really like that. Yeah, I thought that was very strong. Yeah, and fun as well.

H4: Yeah,.

F1: Why? Because it's fun for something else.? What do you mean by strong?

H5: I guess that's well strong because to see it visually.

H1: Yeah, you have to physically. Yeah, much better like this than up there (pointing at battery graph).

H5: Yeah, completely.

H1: Because we can manipulate it and say, well, what if that goes there? I think so. I think. I think that's really good. I really encourage you to scale it so you could just use Legos because that would save a lot of time.

H5: Or what are those? You can get those.. I forget what they called .. the blocks that are..

umm we use them when I was doing language stuff and it was like ‘this is twice as big as this, you know, you know, the blocks, I mean, they're different colors.

F2: yes, they're called the manipulative. They're like for doing maths.

H5: yeah, yeah.

F2: She did want to use Lego, it was my fault we did not use Lego

H1: For you were right.

F2: But its plastic

H1: But if it already exists in the world, you can't go and buy new Lego, but you can borrow some Lego.

F2: That's where my kids would have objected.

F1: Ok. So yeah, the other thing would be that, uh, we we've shown you in various visualizations, one where you were annotating in your houses, one is a physicalization one is a digital interface how do you compare to each one? You already said that you prefer the physical one or..?

H1: I think the physical one is good because we can physically manipulate it collectively. I I didn't need this at home. I think was the screen interface was perfect, but here we're doing more of that comparative thing, aren't we? You know, this is what your life looks like and this is what my life looks like and how can we like the fit together? So I think they're kind of different things for different purposes.

H4: Yes.

F2: You can also say no, you don't have to.

H4: But it's a bit a pitty we're all of an age, people that got along because there's no people, young families here ares there?

H1: They don't have the time.

F1: No, we have participants. The are scheduling amongst you as being part. Even though we had a lot of participation for for installing the kits. Yeah. It's the idea of the surveying and how much like I send the survey out. And only you, three months to align for one date. For now. So I sent another survey. So we have another 3-4 in the next session. So it's a little bit harder for that.

H1: It would be Really interesting to know as a participant how families, households with with different profiles, how they come at this and and how this looks for them as well.

F1: So you're saying that you think you were to similar in their being the profiling here,

H1: not too similar. I mean we just we just do produce, we did produce a similar curve but looking at how it could be applied in the real world and I think that would be really important to know and I'm thinking about how I might engage with other users that maybe don't have lives that look like mine.

H5: But maybe That's a positive because if people are doing their consumption early morning and then shoveling the kids off to schools and then early evening and then bath time and bed. But, you know, we're doing things at different times in the middle of the day or.

H1: Yeah, definitely.

H4: It would be to see a family, young family having a bunch of showers the morning having to cook at 6:00 o'clock because kids are hungry in the evening and see how that fitted in. That might match perfectly around us. Yeah. Or not.

H5: yeah you know, there could be a sort of dove tail.

H1: Yes, exactly.

F2: And the last part is, do you have any questions or anything else you would like to give feedback on? I'm very open.

H1: What's the next stage of your project?

F1: So now we are actually looking at what the collective system might look like. What

the next stage would be is to see out of these workshops, we're getting ideas and kind of feedback on what the collective an app or some kind of system that could support collective consumption, let's say. And then we were planning to prototype that. So you're very welcome, of course, in the second stage of the research as well, we're gonna start after these sessions in the workshops, then this will be probably in autumn. So yeah.

H4: what's the.., how many participants do you have in this actually recording it?

F1: How many?

H4: how many people you got recording the logging their data?

F1: we have right now 10 and we're having another 4 for next week because we only have 10 kits. So it's a little bit difficult to do more at the same time unfortunately and that's why it's been hard also to organize coordinate the groups I think.

But from what I understand from I don't know, maybe I'm making conclusions too fast here is that you wouldn't be too much on board on a system like this of coordination.

H5: It feels clunky. Yeah, it feels a bit intensive and. Just feels a bit like, you know, you're trying to put your life into a box, but I think that's just about people dealing with change.

H4: I mean the electric car you have to charge those – you have to plug one when you get home. That's a change in what we do. I go to the petrol station once every two months normally, yeah. So that's not a thing my life. If I had an electric car, I would need to charge it whenever I get home and that's the whole change we have to go through anyway. So perhaps this will slot in that sort of changing mentality.

H1: You know, I think it's all about the protocols. You know how how you go about communicating the ideas and how you go about setting rules, how exceptions work.

Who pays for where we break the rules, you know, if I decide to to, you know, charge my car here when, let's say my battery is empty and I and it's all coming off the grid. Who pays? to be split that cost three ways?

H4: Or was it windy then and we had a wind turbine.

H!: Yeah, or or or my pay get, you know, like you were saying with the washing. It's not worth it. It's worth it to me to pay £1.24 for a load of washing rather than 85 P because I wanted done now. You know, I think the devil is in those details, but I think in the development of of that you know you you I think you can see a way where it could work.

And I think we have to think differently.

H5: You you probably remember it better than me, but there was some. There was a book. That was written was probably about. That's five seven years old by two economists. And each chapter was a kind of different kind of behaviour type thing, and it was like why drug dealers live at home with their mom, because actually they're not making that much money, you know, and it's a pyramid selling scheme. But one of them was really it. It got me because it was it was a story about a nursery and I think it was in Israel, it was. And what they did was they found that parents were getting later and later picking their kids up after their allotted paid for time and so they said, well, we will charge you a penalty. And the parents then thought about it, and they thought, well, that's fine because it's like giving them permission.

H1: Yeah, to.

H5: To pick up their kid later. Yeah. So it was a bit of a kind of, did it really work? Not quite like they intended it to. Umm, you know, whereas I think the peer pressure of saying hang on a minute our staff can't be waiting here for you. You know it's like your time’s more important than theirs?

H4: I think it was Freakonomics.

H5: Yes. Two American economists.

All right. Well, from us that's that's everything right now. You can give me your kits back.

[….]