

Group	Section	Question	Answer
	Case Study	Can we assume that we are looking to minimize curtailment losses for the one particular turbine or scale the losses up to the level of Orkney islands? If scaling is required, can we assume the same levels on curtailment, irrespective of when the other projects came on stream?	The island has over 500 turbines https://theorkneynews.scot/2018/09/02/has-orkney-had-enough-of-wind-farms/ , so the question is about the average turbine curtailment. Yes we effectively want to minimize curtailment (energy waste) by enable household to become flexible consumers of net electricity.
	Case Study	Should be limit the scope of analysis to use of excess electricity for domestic heating or explore other options as well?	Yes please limit the scope to domestic heating
	Case Study	Should we assume that we are looking at the project at the beginning of 2018, i.e. only considering information available at that point. Should we look at the project in isolation, on its own or with consideration of other similar projects which are being executed on the islands?	Project in isolation
	Case Study	In order for the solution to be feasible (and successful), who would need to be persuaded to change the status quo: only the residents, who will be benefiting or also other parties (e.g. utilities)?	This is a ROI analysis, so first our stakeholders (at Kaluza) would need to be persuaded
	Case Study	Who will be the audience for the case presentation in this case?	See answer above.
	Case Study	Could you confirm for the case who our client is? And who "we are meant to be"?	You are playing the role of a Business Analyst at Kaluza. You must assess the financial viability of the project, but not only in terms of financial benefits to Kaluza, but also in terms of financial savings to the Community.
	Case Study	If there are any outliers for number of households In the energy consumption dataset, would I be ok to ignore the outliers as I've avg/mean energy consumption and I can calculate impact based on island population?	if there are outliers, missing data - use the good data. Since consumption is seasonal on a daily, and monthly basis we can infer that based on the existing data and assume that the average consumptio is equal to this profile.
	Case Study	"During the HSO trial programme, residential consumers who participate will be fully reimbursed for the energy that their Kaluza controlled devices consume. This means that any avoided curtailment will be delivered to wind generators at their normal wholesale value (so effectively for free)."	Not important. But we don't return energy to the wind generators. Any un-curtailed energy is either exported or fed to locals if they are part of the program. Assume a discounted version of the wholesale price. (In the Q&A spreadsheet we suggested considering discounts of 25%, 50% and 75% percent.)
	Case Study	Does it mean that Kaluza would reimburse the heating energy bill whenever the households consumed that heating energy with installed Kaluza's technology? At kaluza's payment? Or payment by any project grant? If it is at Kaluza's payment, then it should be considered the implementation cost to Kaluza right? Say household is saving 1kWh of heating energy from the DR technology, Kaluza will pay that 1kWh at the electricity retail price to the household?	Not important. Initially paid by a grant, and eventually by Kaluza + government subsidies.
	Case Study	On the second part where any avoided curtailment will be delivered to wind generators at their normal wholesale price (so effectively for free), does it mean that Kaluza will not need to pay the wind generators at all (hence the 'free' meaning here). And wind generators will in fact able to increase their revenue with these avoided curtailment where the increase is equivalent to the wholesale price times the avoided curtailment.	Not important.
	Cost	What would be the costs associated of rolling out a DR infrastructure for the company.	This would have to be estimated by the analysts (you) using a number of different scenarios.
	Cost	Are there any additional costs we need to consider when generating energy to the locals in Orkney (eg. are there already facilities to provide energy to locals)?	KISS = keep it stupidly simple to begin with. Assume a very simplified cost structure. There are fixed costs per installation of control equipment per household. All other costs have been amortised over time since the same infra-structure supports other functions in the company.
	Cost	What are, besides the lost revenue, the costs for curtailing (operational, project financing implications)?	Curtailing means wasting energy, so the question is how can we avoid wasting energy and monetise on it.
	Demand	Demand fluctuates between 0.1KW and 0.5KW. Do we assume the average consumption (currently 0.2KW) remains the same following the introduction of the new system?	Average consumption relates to the usual energy demands from the average household. The demand will vary with a number of aspects, some are "averaged out" like household occupants, but some are time dependent, such as seasonal requirements
	Demand	How many households have smart heat system installed?	People, in general, would tend to consume more if energy is free or really cheap but to begin with imagine the same consumption profile per household per day, and perhaps stay on the conservative side (use the median, or a higher quantile). Be aware of outliers too.
	Demand	Can you please give any information about the Storage heaters, flow boilers, hot water cylinders and immersion elements (acting as energy stores) mentioned in the above website? How much energy they can store/consume etc on average?	OWN RESEARCH / No need to dive into these per say. Focus on space heaters. If time permits, on your conclusion you could discuss how you could expand your analysis into a broader class of electric assets. https://www.dimplex.co.uk/product/quantum-heater and make assumptions about which fraction of the day average person heats their house, and at what rate.
	Demand	For every household that is introduced in the DR program, what would be the total capacity of energy storage in the systems compatible with DR (in KWh)? What is the power rating of these systems (at full power - kW)? What is the average power consumption of these systems (kW)?	OWN RESEARCH / Too much info. See previous. answer

	Demand	Can you explain the term DR penetration – Are we talking in terms of number of households or pure power demand to be triggered from each household?	Assuming average demand per household, DR = total number of households
	Demand	In the residential_demand.csv file, the number of sample households changed dramatically over the period of time? Is there any reason?	Yes, it's the mean demand across all households
	Demand	Is the demand_mean_kw the electricity consumption per household?	
	Demand	What are the various sources of energy consumed by a household?	OWN RESEARCH / Too much information. Assume that most of a household's energy consumption is due to heating/cooling. https://www.ofgem.gov.uk/gas/retail-market/monitoring-data-and-statistics/typical-domestic-consumption-values
	Demand	The number of households in the sample data increased to 32000 during Sept 2017 to Oct 2017, was there a reason for the sudden increase in the number of households?	It could also be an anomaly in the data. (The data is dirty.)
	Demand	Was there a reason for the increase in the number of households in the sample at the end of 2017?	It could also be an anomaly in the data. (The data is dirty.)
	Demand	The average daily demand has been increasing since 2017 August, would you know if there is an external event that may have caused this?	It could also be an anomaly in the data. (The data is dirty.)
	Demand	The demand dataset is only available for 2017. Is 2017 a representative year for the present demands of Orkney or was there a specific reason 2017 was chosen?	Ditto
	Demand	Does the demand data include residents in the mainland or is it just from Orkney?	Orkney
	Demand	What types of residents will be chosen for the HSO trial? And does the demand dataset accurately represent them?	Assume it does represent them
	Demand	Do the demand numbers cover all domestic electricity consumption? Our comparison with statistical data for the period suggests that some electricity usage is excluded, which might be important for our analysis.	Not needed
	Demand	Does the customer have granular electricity import data, so that we could include it into the analysis?	Not needed
	Demand	All the household in the scheme would only use curtailed energy, and their energy 'need' is equal to the demand in the dataset.	That's an assumption to be made - the reasoning is, base on their proxy consumption, and assuming that most of the energy used is for heating how much energy could we save if the average household is subscribed in the program.
	Demand	A resident will be happy to pay for curtailed energy to satisfy her energy demand as long as it is cheaper than the alternative	The idea is that there's a subsidy. At the beginning of the trial the energy is free, but the idea is to estimate how much of the wasted energy can be monetised.
	Demand	For energy consumption in kWh, would I be right in saying if avg energy consumption is 1kw per minute for 60 minutes, then energy consumption is 60KWh and commercial calc should use 60KWh for one hour of energy consumption? Likewise, 2kw consumption per minute for 60 minutes will result in 120KWh and so on...	Energy of 1 KWH = the rate of energy production is 1 KWH per hour. (Energy units can be confusing if you haven't taken engineering nor physics courses before.). Assuming a uniform rate, then 1000 WH / 60 min, or 17W per minute (which when integrated over 1 hour) should give you 1 KWH. https://www.wolframalpha.com/input/?i=what+is+1+kwh
	Demand	Is the demand data based on households in Orkney or elsewhere within the UK? We have been unable to reconcile the data to publicly available information on electricity consumption within the Orkney Isles even when allowing for the sources of energy to heat homes (from the energy audit). This will have an impact given the usage of electricity for heating is higher in Orkney compared to the rest of the UK.	Assume Orkney. Also it doesn't matter -- it's a proxy.
	Demand	how many households are there in the islands?	10,385 https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/households/household-estimates
	Grid	The link to the mainland is 40MW and production is limited to 900KW, therefore it is never a limitation. Do we assume that the link to the mainland should be 0.4MW?	No, we only show 1 turbine as an example, there are many more turbines in the Orkney isles. *As of September 2018, Orkney had more than 500 turbines https://theorkneynews.scot/2018/09/02/has-orkney-had-enough-of-wind-farms/ **Also bear in mind that it's not always that the mainland can consume the excess energy -- wind energy is intermittent and sporadic, and the grid is a zero-sum game, so it's not always possible to export excess energy.
	Grid	Does Orkney have the facilities to store energy?	Nope. But each household that subscribes to the program would
	Grid	The set point for the generator's maximum output is 900kW, while the connection cables to the mainland is 40MW which means that the cables should have more than enough capacity to transfer the maximum output to the mainland. What is the reason the connection cables were mentioned as the bottleneck for the current system?	No, we only show 1 turbine as an example, there are many more turbines in the Orkney isles
	Grid	From our understanding, the wind energy supply from Orkney is supplemented with other energy resources, what are the other types of resources and does the supply also fluctuate as well?	They are mentioned if you look carefully. Some people in Orkney are not currently using electric heating, for example, so they depend on gas, oil or other fuels

			<p>#### Load data</p> <p>One year of aggregated residential electricity demand data, aggregated over several thousand households in order to remove personally identifying information (PII).</p> <p>Columns:</p> <ul style="list-style-type: none"> - Timestamp: the datetime in UTC of the measurement. The timestamp is situated at the end of the measurement period. - Demand_mean_kw: the mean demand of the sample of households during the measurement period. - N_households: The number of households included in the aggregate statistics of the measurement period.
	Grid	Are we right to understand the half-hourly data in the energy demand file as consumption for the period rather than an average rate of load (so that hourly aggregation is a sum rather than a mean)?	
	Pricing	How is the value of the energy exported calculated?	We're not considering export numbers
	Pricing	What price are local residents paying for energy currently and does this value pass directly to the producers?	We can assume typical numbers 50-100 pounds / month per household (or the equivalent in KWH) https://ukerc.rl.ac.uk/DC/cgi-bin/edc_search.pl?GoButton=Related&WantComp=94
	Pricing	What is the assumed discounted rate that they would be charged for adopting the new system and how would it be applied?	There has to be a break-even point, where we start making profit. We suggest you work out a few scenarios: subsidies of 25%, 50%, 75% and 100% of energy cost and see where that takes you...
	Pricing	Can we have electricity pricing data for the period or an indication of the price difference between peak and low demand periods?	Assume typical prices, or research the typical consumption profile for that geography.
	System	Supply data is provided every minute. How fast could a demand regulated system respond and therefore is there a need to aggregate the supply info over a set time period? What would be an appropriate timeframe? Would you use the min value or average?	The idea is to create flexible demand for which activation is nearly instantaneous -- we can switch on a heater as soon as we observe that there's excess wind power available
	System	Can you give the timelines of HSO trial project as mentioned in http://www.rewdt.org/HSO.php . When did the installation of devices started and completed?	Not needed
	System	Is the HSO trial only going to be done on residential devices? Is the any portion of the energy considered for others like industrial devices?	Not needed / focus on residential clients first (Orkney is not a bustling commercial town)
	System	How will the value of the system be judged by? Is the goal of HSO to be more environmentally friendly or is it to reduce the cost of generating excess energy? If it is about the cost, do we have any values regarding the costs?	How much energy can be saved, and therefore money, by having X households in the program? One can eventually think about subsidy schemes for the program
	System	From the industrial insights, you've mentioned that the role of Kaluza is to supply energy to residents who can have a delayed energy demand. Do we have any information on the proportion of demanded energy in the dataset that can be delayed? (eg. the proportion of the energy demand that are for heat storage and hot water cylinders)	Delayed means = customers are not always consuming energy in real time as excess wind power arises
	Wind Turbine	What is the significance of the set point? Is this a physical limit on production and how is it controlled?	Set point allows us to stop generating more energy in aggregate than the infrastructure can cope with. Needs to be considered as a whole.
	Wind Turbine	Power is almost always less than setpoint, i.e. does it mean that production almost reaches capacity? Is this expected?	Yes it means we generate maximum possible power. As to whether it's expected, think about what would happen when we have many more wind turbines in Orkney. Different sides of the isles, different wind profiles. What needs to happen in order to manage all set points?
	Wind Turbine	We have missing telemetry data in 2015 (only 4 months and just a handful of days have data), 2017-04 (only 10 days w/data) and 2018-01 (only 11 days w/data). Is this expected?	That's fine. Nature of the beast. Real world data sets are dirty.
	Wind Turbine	Why the energy produced from this turbine in 2017 is greater than 2016.	One possible answer: different weather, there may be more. Think about it...
	Wind Turbine	How many wind turbines are there in total?	Around 500+ in Orkney, but can assume our telemetry is that of a typical turbine.
	Wind Turbine	In our study the wind survival speed: ~30m/s. A significant amount of energy is lost that way. Is it possible to consider an increase in wind survival speed of the windmills as a possible improvement?	Not windmills, wind turbines. No that's an engineering safety limit. The problem is not producing more energy is to waste less.
	Wind Turbine	There are several cases where the energy output of the windmill is 0kw, even though there is enough wind to produce energy. Can we assume this is only due to curtailment? Or can it also be due technical issues with the mill?	This is real world data, so it could absolutely be due to at least those two reasons, but curtailment can be seen through the set point, so make sure that if you get a 0kw output it's because curtailment was set to 0, otherwise, there may be other reasons.
	Wind Turbine	There are many missing data points in the power, setpoint and wind columns for the turbine telemetry dataset, what is the reason for the missing points (eg. most of 2015 and in Apr 2017 for wind data are missing)?	See previous answers.
	Wind Turbine	Is there any cost to setting the setpoint at a certain level that we should consider? Eg. damage to machinery.	Assume the it is safe to set the set point to any value on or below the maximum output of the turbine. That is part of the turbine's design.

	Wind Turbine	What is the cut-in and cut-out speed of the turbine?	Look at the data? Not particularly relevant here.
	Wind Turbine	If Orkney periodically faces winds above the cut-out speed, do we assume that there will be no power output from the wind turbines and is there a delay to restart the turbines after shutting them down?	Look at the data? Again, not of great relevance in this case study
	Wind Turbine	What is the rated speed of the turbines?	Parameter given
	Wind Turbine	Is there a delay in which the energy is generated? (ie. when the wind speed is too high, can we assume that the energy is generated instantly and the set point would be adjusted accordingly?)	The delay is negligible for the purpose of this exercise
	Wind Turbine	Is there a cut off speed/safety measure in the turbine?	When the storm control system is deactivated, the turbine stops as soon as an average wind speed of 25 m/s in the 10-minute-mean or a peak value of 30 m/s is exceeded. The turbine restarts when the wind speed constantly remains below the shutdown wind speed.