

## Design Project Frequently Asked Questions, March 3, 2022, v1

1. Scalability:
  - a. *Are there expectations regarding scalability of the system with expansion or removal of population/homes?* The spec doesn't say anything about this. For the present, design to the spec. That said, when you get to the final version, we might ask you about potential limits to scalability in your design as part of an overall evaluation of your design.
2. Security/Privacy
  - a. *What are the opportunities for tampering with or gaining access to information?* At least for the present, we have set aside any security or privacy concerns. Because we won't get to these topics until later in the term, they cannot be part of the challenge for the DPPR.
3. Performance
  - a. *Is there an upper bound for the time needed to perform the power-sharing algorithms? How fast should your system respond to changing demands?* The system needs to respond in human time frames, so that may be counted in minutes. You should plan that any update to power management should take on the order of no more than one minute.
  - b. *What is the benefit of using lossy aggregation when there will never be a concern for storage size when using lossless aggregation?* Storage isn't the only resource that might benefit from aggregation.
  - c. *Does the central utility have access to infinite amount of storage and for an infinite amount of time?* No, see the specs on the central utility machine.
4. Failures
  - a. *Is there any relationship between the microgrids and the power line wiring? How can we predict which group of houses will be disconnected if a tree falls on a power line?* The microgrids are a management system. They communicate via LTE and the wiring that the phone company provides. The power lines are run by the power company. They form a completely separate system. That said, the people who run the power lines have extremely good information to localize power line failures. It isn't perfect, but they know exactly where to send the person in a truck. They also know which lines go to which houses.
  - b. *When local production can't meet demand for all microgrids, how should we prioritize which microgrids get additional electrical power?* Each unit (house, apartment, municipal building) has a direct feed from the municipal light company through their smart meter. They can get up to the amount electricity determined by their electrical service. The first way they get electricity is from their local solar panel farm. If that doesn't provide enough the municipal light company provides the remainder, if they need it. The municipal light company gets it either from its own batteries or the regional electric utility. The system doesn't set priorities.
  - c. *Can individuals pay more for higher priority for electricity?* No. No priorities. In the grander scheme of things, a home owner could upgrade their electric service to something higher than the 200 amp service, but that requires an electrician and the municipal light company approval and is not part of this design.
  - d. *Do the microgrid controllers have some sort of backup power system in case of a power failure?* Yes, we forgot to specify that. They all have rechargeable batteries and can last for 48 hours on those. The smart meters have the same 48-hour battery backup.
5. Stakeholders
  - a. *What about sharing power within a microgrid? Is there no credit or charge for this? What about people who do the bare minimum?* The microgrid is true sharing without monetary exchange among a group of neighbors. Notice that if a homeowner sets their power limit at 75%, so they only will have 25% to share at most, they maybe begrudging their neighbors more support, but they also will only be able to feed at most 25% back to the central utility,

for which they would receive compensation on their power bills. The battery limit goes both ways. One may not share as much with one's neighbors, but one also will not be able to recover as much on one's monthly bill from the municipal light company.

- b. *Why is there only one smart meter per apartment?* The apartment buildings are organized differently from the houses. As described in the spec, each apartment building has a feed into each apartment, so 100 meters. It then has a single solar panel farm on its roof, with its own battery system and a single meter. The solar panels provide power to every apartment in the building as needed, until they run out. Then everyone in the building will be on the municipal light company power until the solar panel system has enough power to provide more. If the apartment building solar panel system has power to spare, it will feed that back to the municipal light system just as a home solar panel system does, but in this case all the residents of the building share equally in the benefits.
  - c. *Do homeowners have to pay for two meters (\$20 per month)?* Yes.
  - d. *How long does it take to recharge a solar panel system?* All the systems, the houses and the solar panel farms can fully recharge their batteries in 8 hours of full sunlight.
  - e. *What can you tell us about the researchers' requirements?* Very little. They don't know yet. They know they want the data. They do not need a continuous and up-to-date feed, although when they retrieve the data it should be essentially up to date. They also do not know how they will use the data yet. They will need to look at the data to figure out what is interesting in it. They will like it to be as accurately reflective as possible. That means that the more there is lossy aggregation, the less valuable it is to them.
  - f. *What about the 48 hours for the municipal light capacity and how does that relate to the later statement about 12 hours?* As stated on piazza, the 48 hours was a mistake. It is being corrected. 12 hours is the correct number.
  - g. *Is there a cost for transferring electricity within or between microgrids?* See 5a above. Sharing power within a microgrid is unencumbered by financial exchange. But also see the other answers above about among the microgrids. Anything providing electricity out of the microgrid is supplying it back to the municipal light company only, so it can keep its prices down. They will receive credit on their bills for this. It cannot be earmarked for any other microgrid. Those decisions are made by the central utility.
6. Communication
- a. *What happens if the communications capacity is overloaded?* We are learning about congestion and overloading right now, so you will know more. If there is simply not enough capacity to send, one option is to send less. This can be done by aggregation, but at a cost. If there is some part of the system that you find simply cannot handle all the traffic, the system will need to either do less or will require more capacity. If such a problem exists, you will need to notify the management in your design document of what you recommend to handle such a situation.