Slide A

Navigate

Warm Up- In Notebook

What are some solutions that might have allowed power companies to dispatch power without needing to rely on working power plants, and thus avoid needing to make inequitable trade-offs that affect communities differently?

Turn and Talk

- What are examples of batteries in your life?
- What types of power sources would be considered batters aka stored power?

Model Energy Transfer

On your own

Complete 2 energy transfer models to show how adding a battery to the system could make it more reliable.

1. In the first model, represent the energy transfer in a system **before** the energy supply drops.
2. In the second model, represent the energy transfer in the same system **after** the energy supply drops.
3. Follow the guidelines in the handout to complete these models.

Slide C

Compare Energy Transfer Models

With another group

- Switch models with a partner. Use the modeling rubric to give feedback.

When you are finished giving feedback using the rubric, discuss changes that need to be made with your partner, and revise your model based on your conversation.

Slide D

Debrief Energy Transfer Models

Warm Up: In Notebook

- How did your models help you explain why adding batteries to our system makes it more reliable?
- What limitations of your models made it harder to show or think about whether a battery would be sufficient to prevent a crisis like that in Texas?
- What new questions do we have?

Consider a Real Energy Storage System

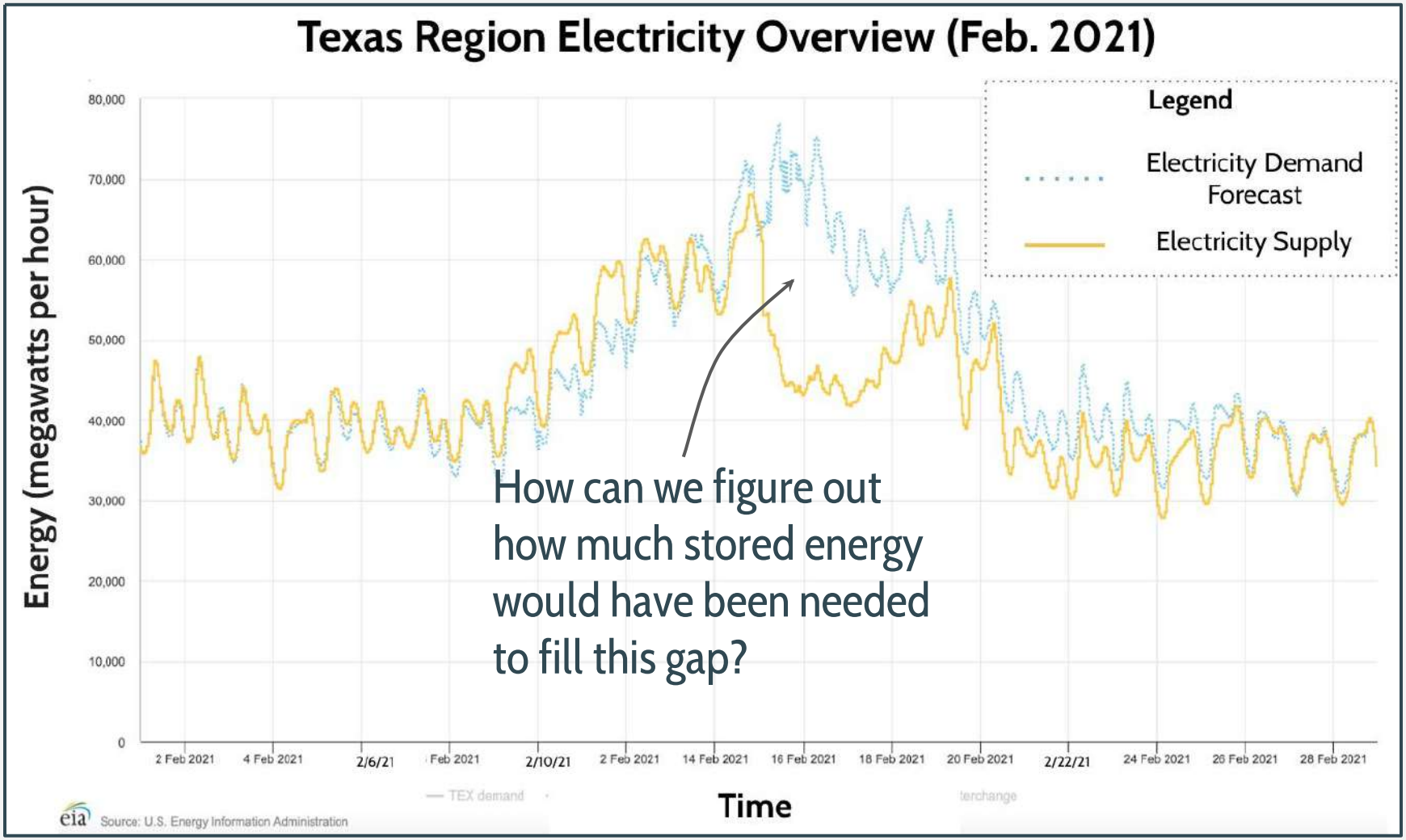
With your class

The Moss Landing Energy Storage Facility can store up to 1,600 MWh (5,760 gigajoules) of energy.

- How many facilities like this one would engineers need to add to the Texas grid to prevent a situation like what happened in February 2021?
- What do we need to know to figure this out?

Slide G

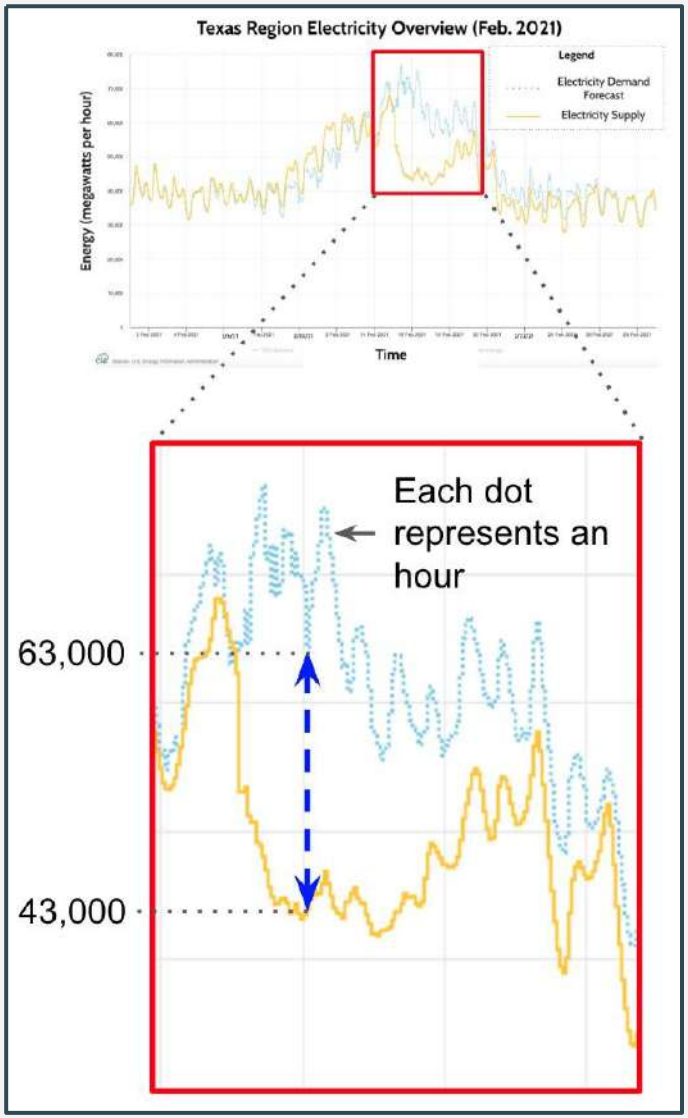
Consider Battery Trade-offs



Consider Battery Trade-offs

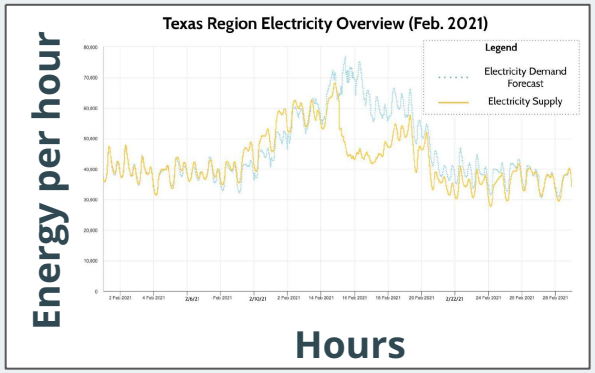
With your class

- How can we figure out the energy needed for 1 hour?
- How can we figure out the energy needed to fill the whole gap?



Dimensional Analysis

With your class



How do we know that the area of the shape between supply and demand will tell us how much energy was missing?

$$\frac{\text{Energy}}{\cancel{\text{Hour}}} * \cancel{\text{Hours}} = \text{Energy}$$

Consider Additional Factors

Turn and Talk

What other factors should we consider when deciding if we should build this large number of battery storage systems?

Calculate the Cost of the Design Solution

With a partner

Building an energy storage facility like Moss Landing costs about $400 million.

- How much would it cost to build sufficient facilities to mitigate the Texas crisis?
- Texas has about 30 million residents. How much would it cost per person to install this solution?

➔ Be ready to share your calculations with the class.

Consider the Challenges of Adding Batteries

With your class

Based on our calculations, what are some of the challenges of building enough batteries in Texas to make the system more reliable?

Consider Different Energy Storage Solutions

On your own

Apply the calculations we did in class to determine whether another energy storage solution might be more feasible for mitigating a crisis like the one in Texas.

Consider Different Energy Storage Solutions

Turn and Talk

Based on your calculations, which energy storage solution(s) might be more feasible for mitigating a crisis like the one in Texas?

➔ Be ready to share your ideas with the class.

Navigate

Turn and Talk

Can you think of any examples of costs that are not financial?

Home Learning and EDT Update

Home Learning

- Read about the costs and trade-offs of chemical batteries.
- Use the ideas from the reading to update your Engineering Design Tracker.
- Be ready to discuss the costs and trade-offs of energy solutions next time.

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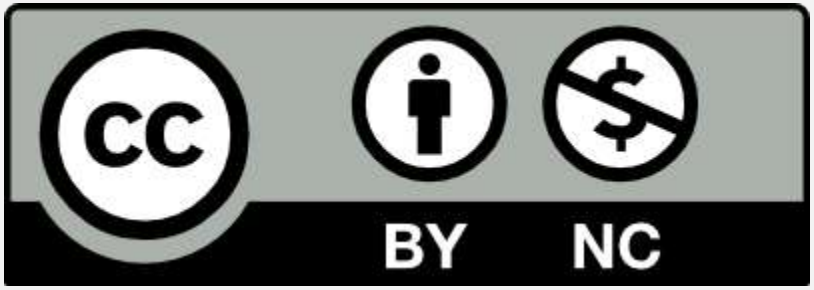

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