POWERING THE BLUE ECONOMY™:

POWER AT SEA PRIZE

AMERICAN MADE CHALLENGES

U.S. DEPARTMENT OF ENERGY

NOAA

Power at Sea Prize: Innovate

June 24, 2024

Housekeeping

This webinar is being recorded.

Please post your questions in the Q&A and we'll answer them at the end of the presentation.

The webinar recording and questions/answers will be added to HeroX.

Agenda

Review of Power at Sea Prize Requirements

Engineering design process for an example OUT OF SCOPE use case

Questions

Power at Sea Prize

Prize Goals

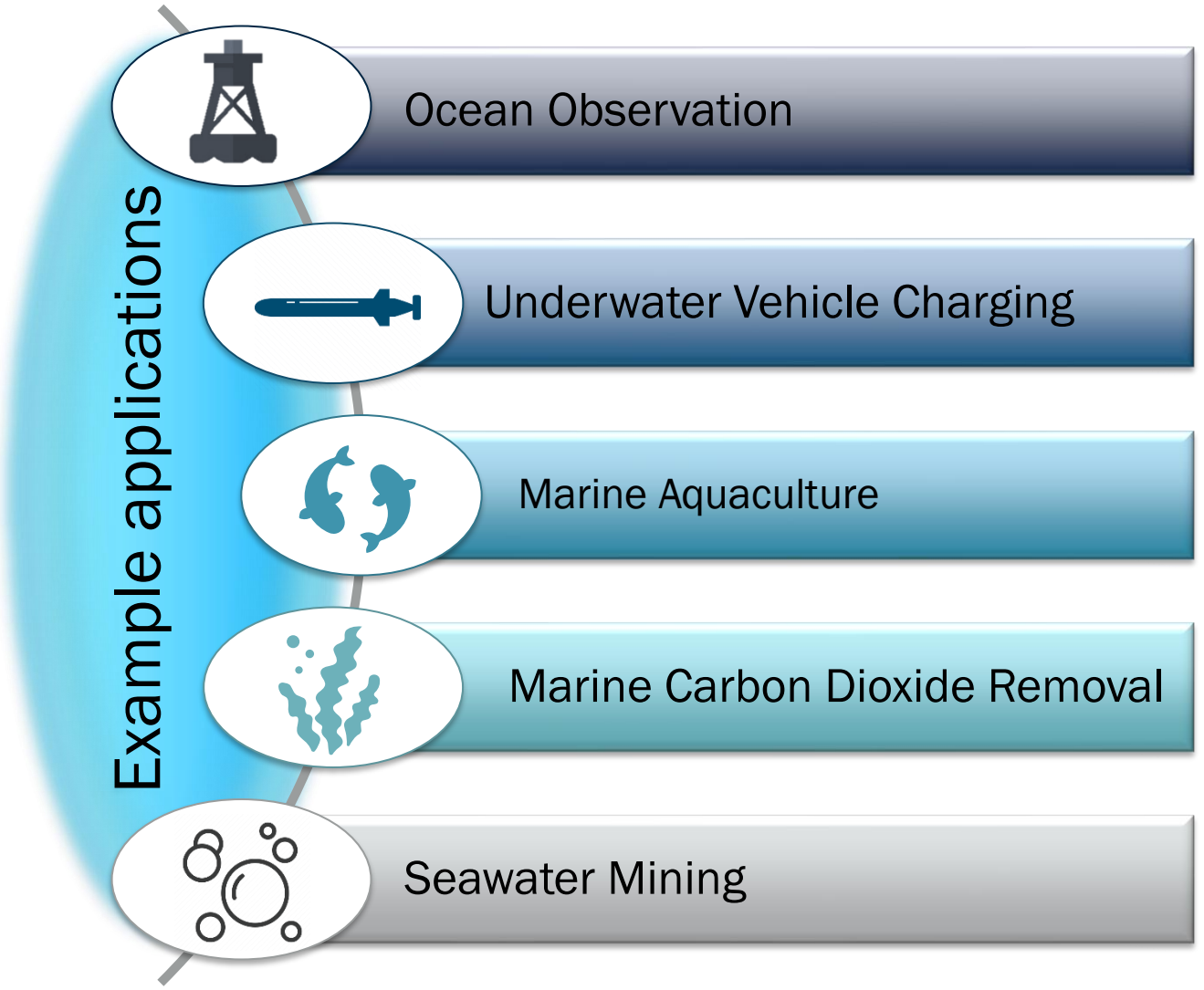
Engage and cultivate a community of **new and existing participants in marine energy** to introduce new, creative minds to Powering the Blue Economy and the marine energy field, fostering the development of new concepts and lessons learned.

Identify **new, innovative, and feasible marine energy concepts** that have a high likelihood of providing power at sea in the near term to accelerate the commercialization of the nascent marine energy industry.

Introduce competitors to WPTO and government funding mechanisms and prepare them to compete technically and financially for future funding opportunities both within and beyond DOE

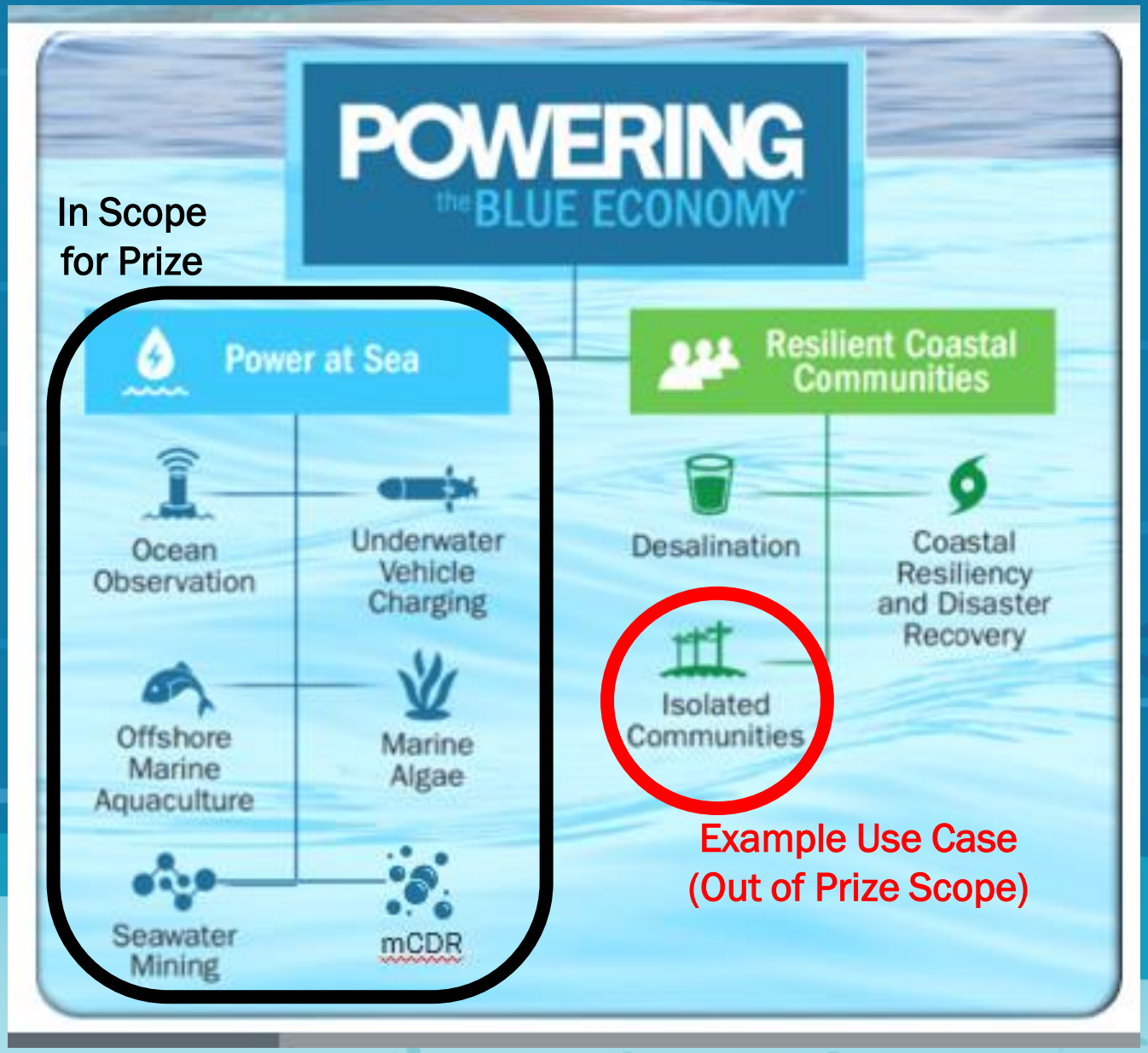
Power at Sea Prize Scope

- Competitors must propose a tangible system, subsystem, or component that receives **more than or equal to 50% of energy needs** from one of the following marine energy resources: wave, tidal, ocean current, river, salinity gradients, or thermal gradients to power systems at sea
- The proposed system must address one challenge area:
  - Access
  - Deployment duration
  - Energy storage
  - Environmental/ecological impact
  - Harsh operational conditions
  - Hybridization with other renewable energy resources
  - Suitability of power

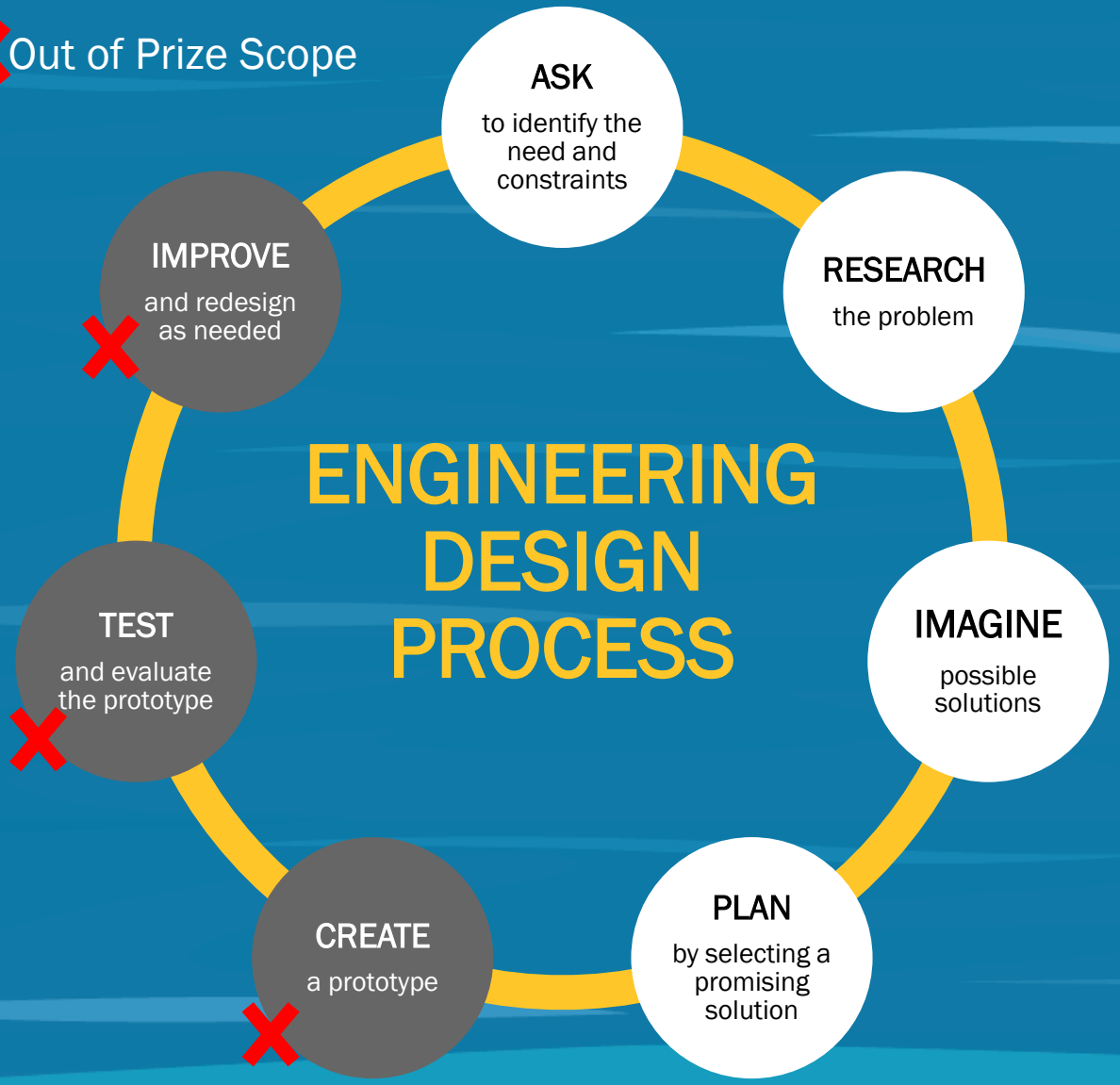


Potential End Uses

DOE Powering the Blue Economy Report link



Out of Prize Scope



Example Use Case: Wave Energy for Remote Community in Oaxaca, Mexico

Identify challenge area

Select energy resource

Determine device specifications

Example Use Case (Out of Prize Scope)

Prize Challenge Areas
(From Rules Section 2.3.1)

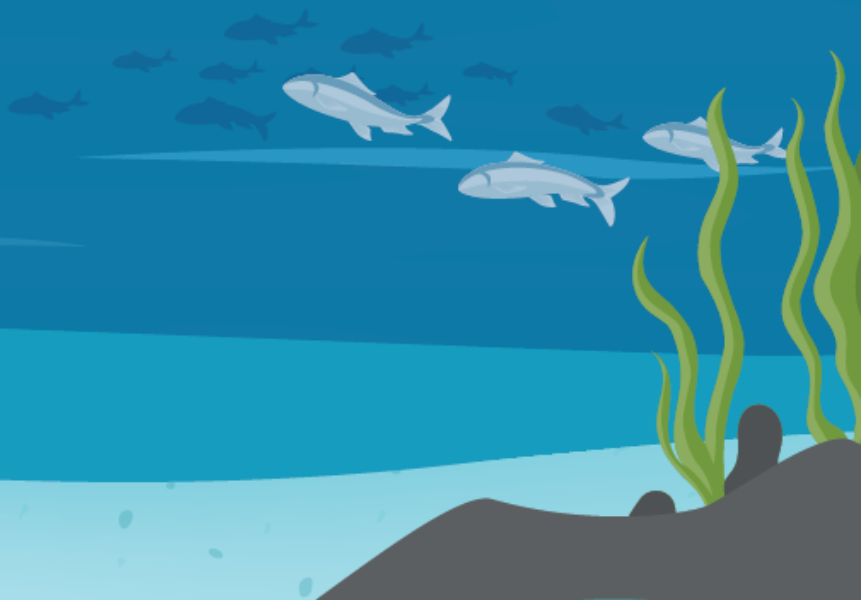
- Access
- Deployment Duration
- Environmental/ Ecological Impact
- Energy Storage
- Harsh Operational Conditions
- Hybridization with other Renewable Energy Resources
- Suitability of Power

ASK
to identify the need and constraints

Identify Challenge Area

Out of Scope, EXAMPLE challenge area:

Electricity Availability



Example Use Case (Out of Prize Scope)

Electricity in Mexico

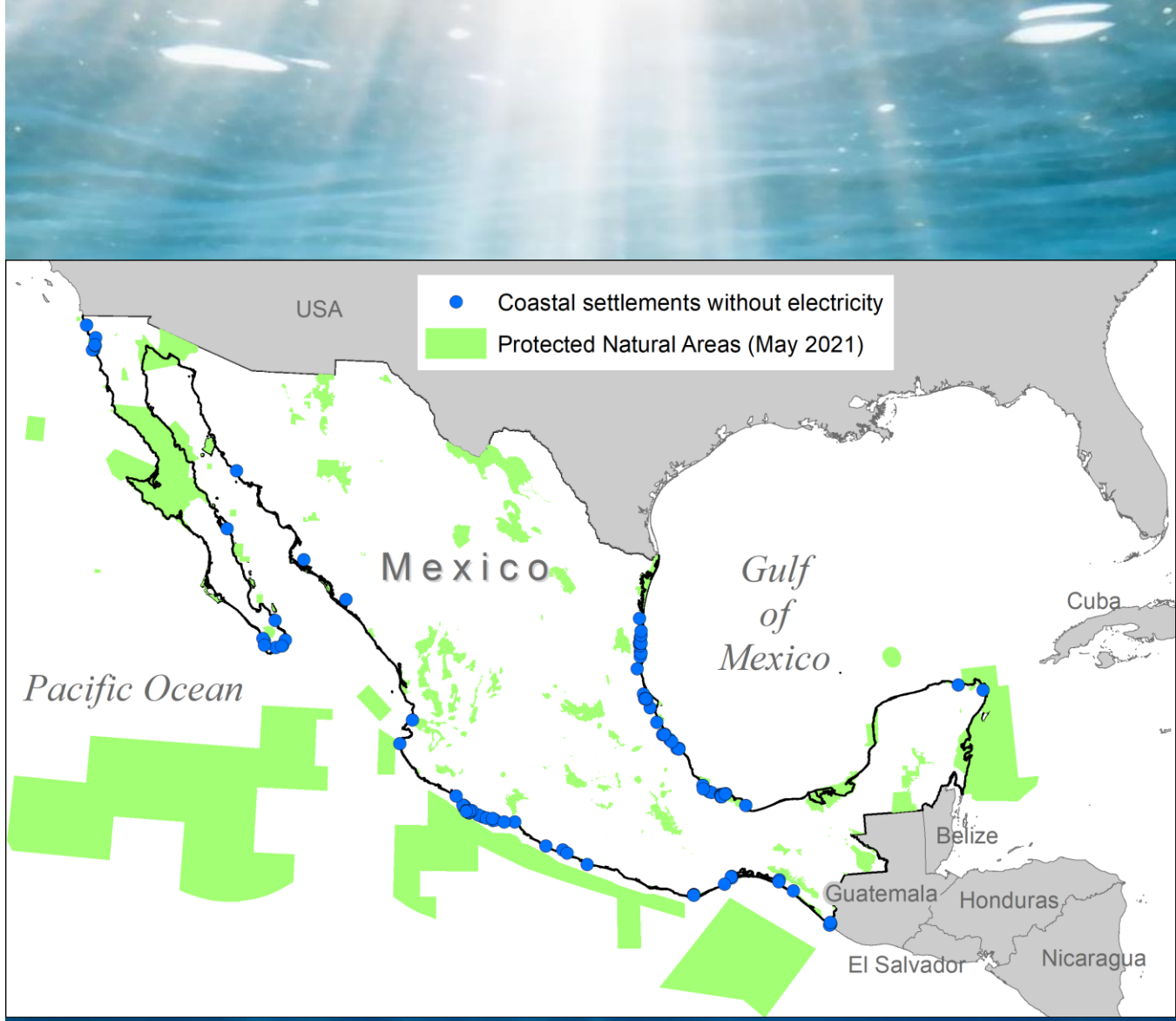
- Mexico is home to approximately 127 million individuals
- State-owned Federal Electric Commission supplies electricity,
- 87% from non-renewables such as natural gas, coal, and other fossil fuels

Example Use Case (Out of Prize Scope)

Remote Communities

- Many coastal communities are underpowered
- <2% of remote communities on Mexico's coast lack electricity altogether

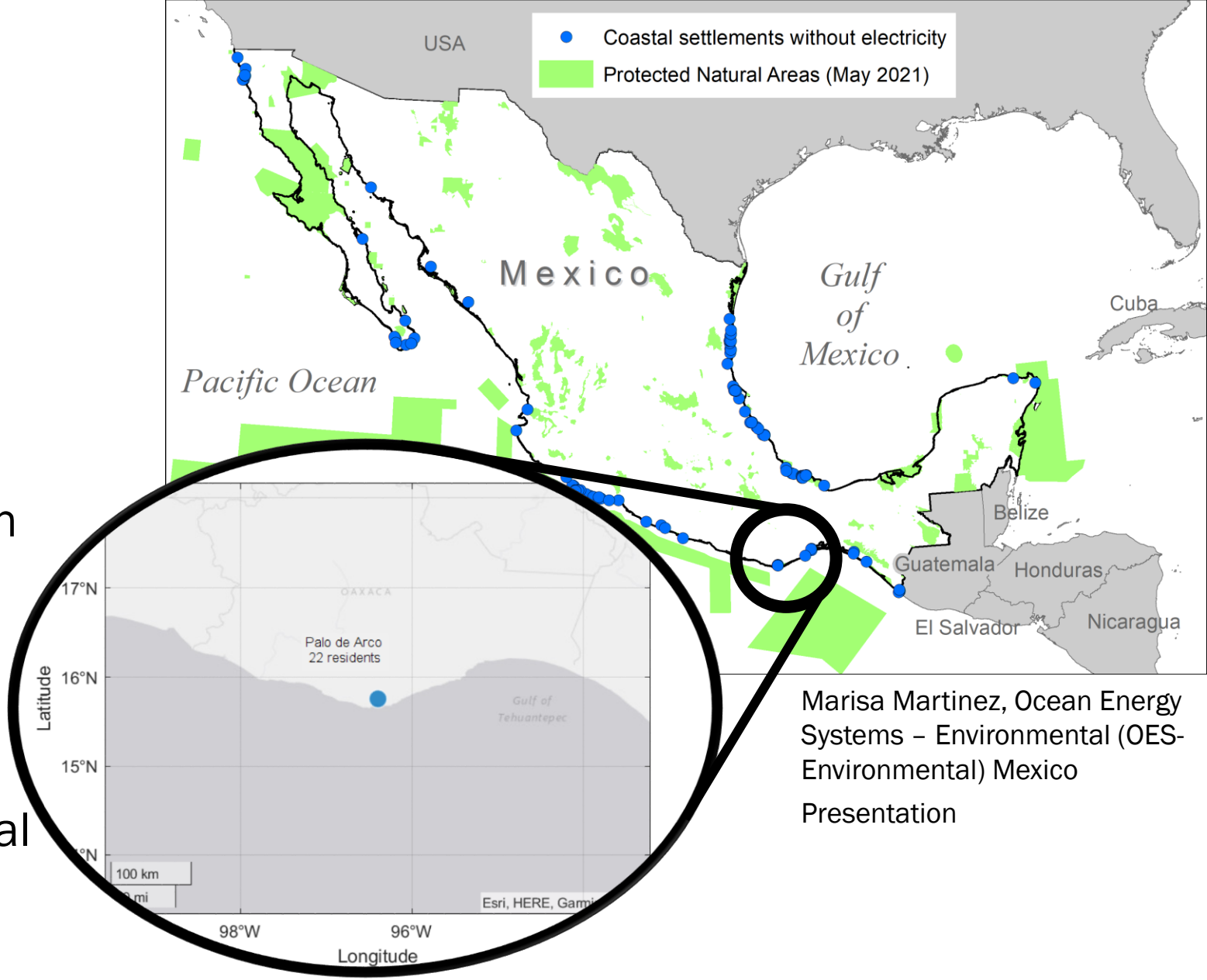
Challenge Area Identified: Access to Electricity



Marisa Martinez, Ocean Energy Systems – Environmental (OES-Environmental) Mexico Presentation Dec 2021

Specifically: Palo de Arco

- Palo de Arco is selected as an example, representative of the many underpowered communities
- Average of 23 residents per community lacking electricity in Oaxaca
- As of 2019 Census, 22 residents in Palo de Arco, all without electricity.
- Near to wave, tidal, and thermal energy sources



Marisa Martinez, Ocean Energy Systems – Environmental (OES-Environmental) Mexico

Presentation

Side note: Engagement with Community

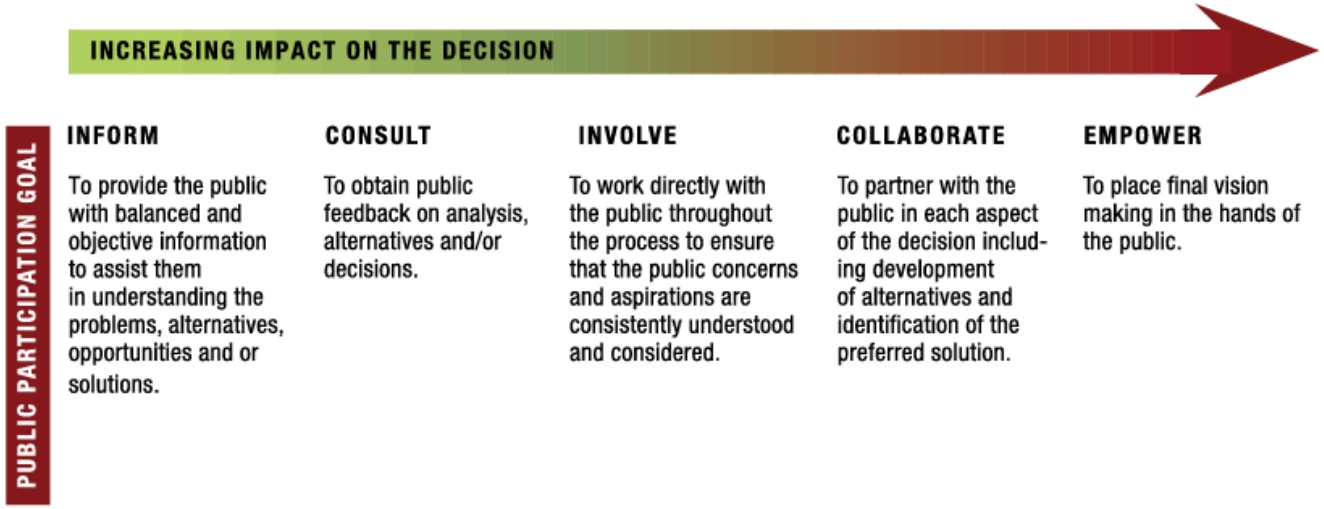
- Not In Prize Scope, but important to consider as concepts evolve into development phase
- Goal: Gain input and reflect the values of stakeholders and communities, and understand if a project is suitable for a particular location from a technical, social, economic, environmental, and regulatory perspective

Benefits

- Minimize negative environmental impact
- Select best site for a project
- Answer questions
- Reduce delays
- Build support for a project

Methods for Success

- Early engagement
- Transparent communication



IAP2 Spectrum of Public Participation. Adapted from IAP2 (2018).

[OES-Environmental Draft 2024 State of the Science Report, Chapter 5]

Prize Energy Resource
(From Rules Section 1.2)

- Wave
- Tidal
- Ocean Current
- River
- Salinity Gradients
- Thermal Gradients

RESEARCH
the problem

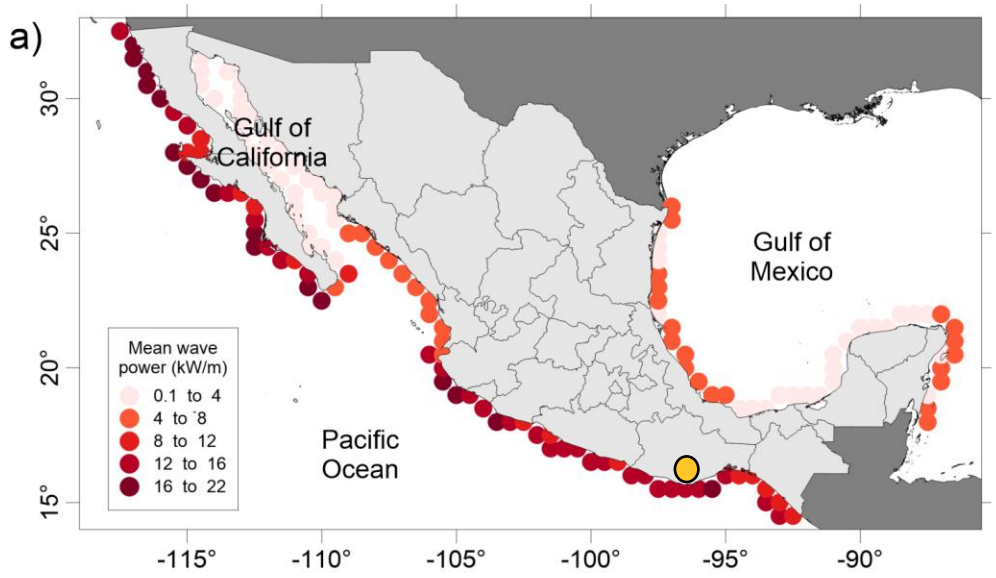
Select Energy Resource

In Scope, EXAMPLE Energy Resource:

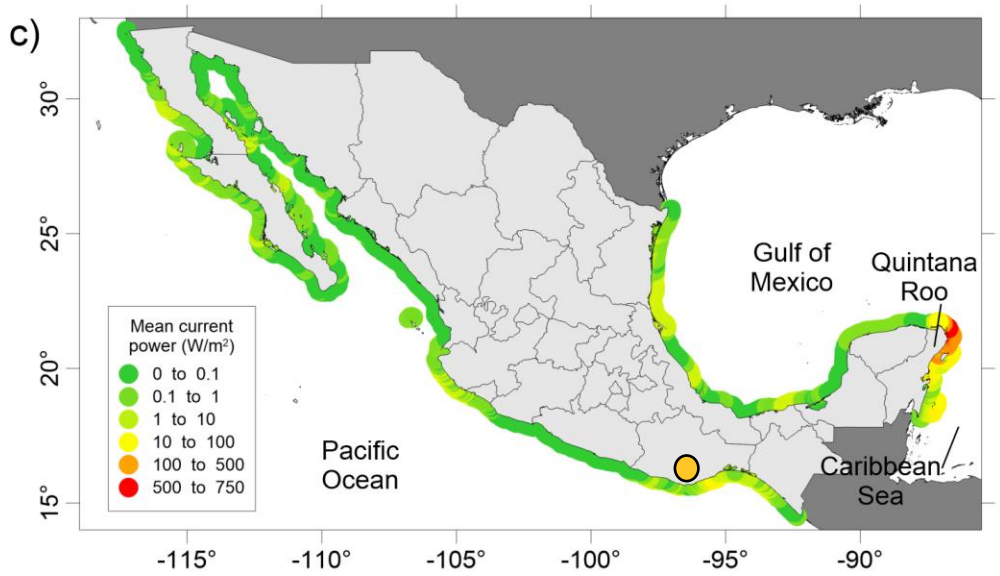
Wave

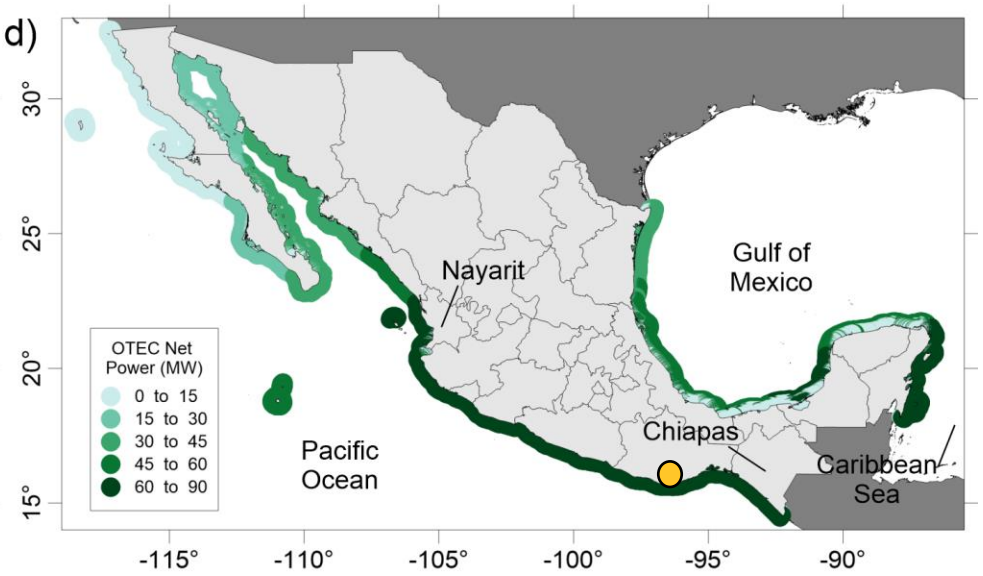
Ocean Energy Potential

Wave



Tidal





Ocean Thermal Energy Conversion

Martinez, 2021. Presentation at OES - Environmental Mexico

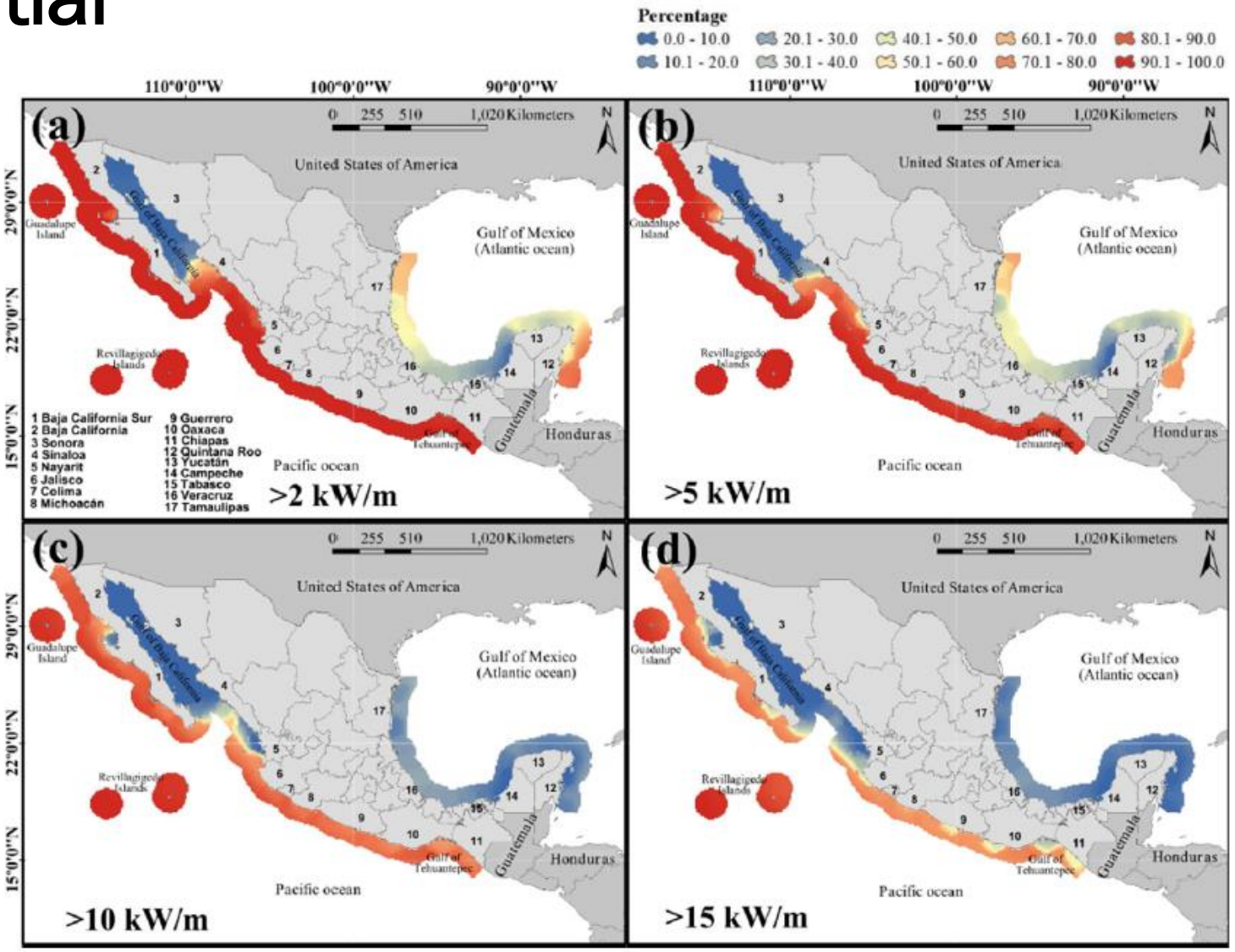
Wave Energy Potential

“On the Marine Energy Resources of Mexico”

Hernandez-Fontes et al. 2019

- Studies quantifying available wave power for the region indicate 10-20 kW/m wave energy density along the Mexican coast.
- Mean wave power potential near Palo de Arco (15.25 deg N, 95 deg W) is available: above 18 kW/m each month
- Near constant power availability

Resource Selected:
Wave Power



From Hernandez-Fontes et al. (2019): Theoretical results of wave power availability in Mexico (in percentages) for the ten-year period (September 2008 – August 2018). Results indicate the percentage of days (over the five-year period) for this power is higher than the established thresholds. (a) Threshold of 2 kW/M. (b) Threshold of 5 kW/m. (c) Threshold of 10 kW/m. (d) Threshold of 15 kW/m.

Prize Technical Narrative

(From Rules Section 4.2.2)

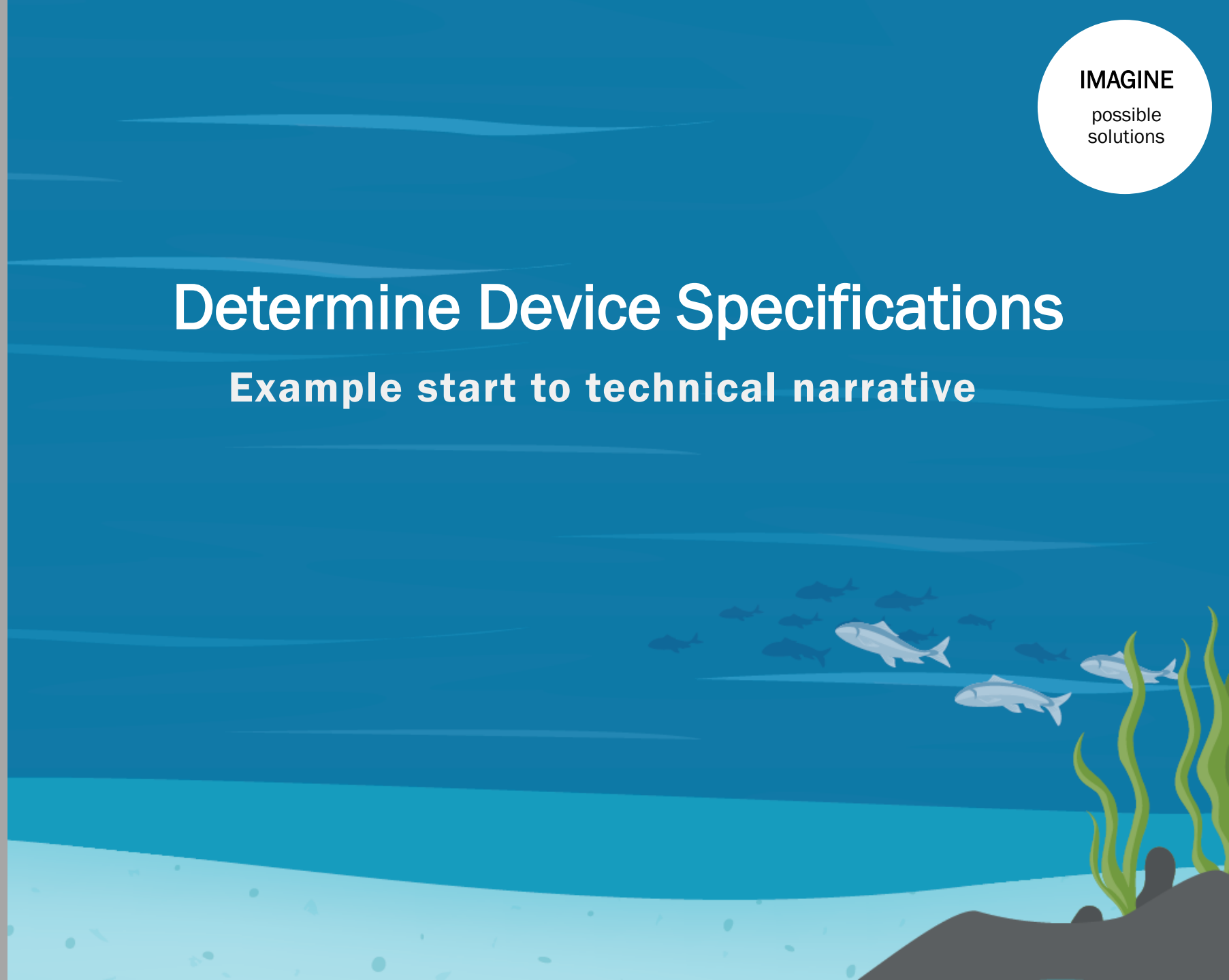
A clear description of the system, subsystem, or component, including any figures or modeling output related to the concept as graphics

IMAGINE

possible solutions

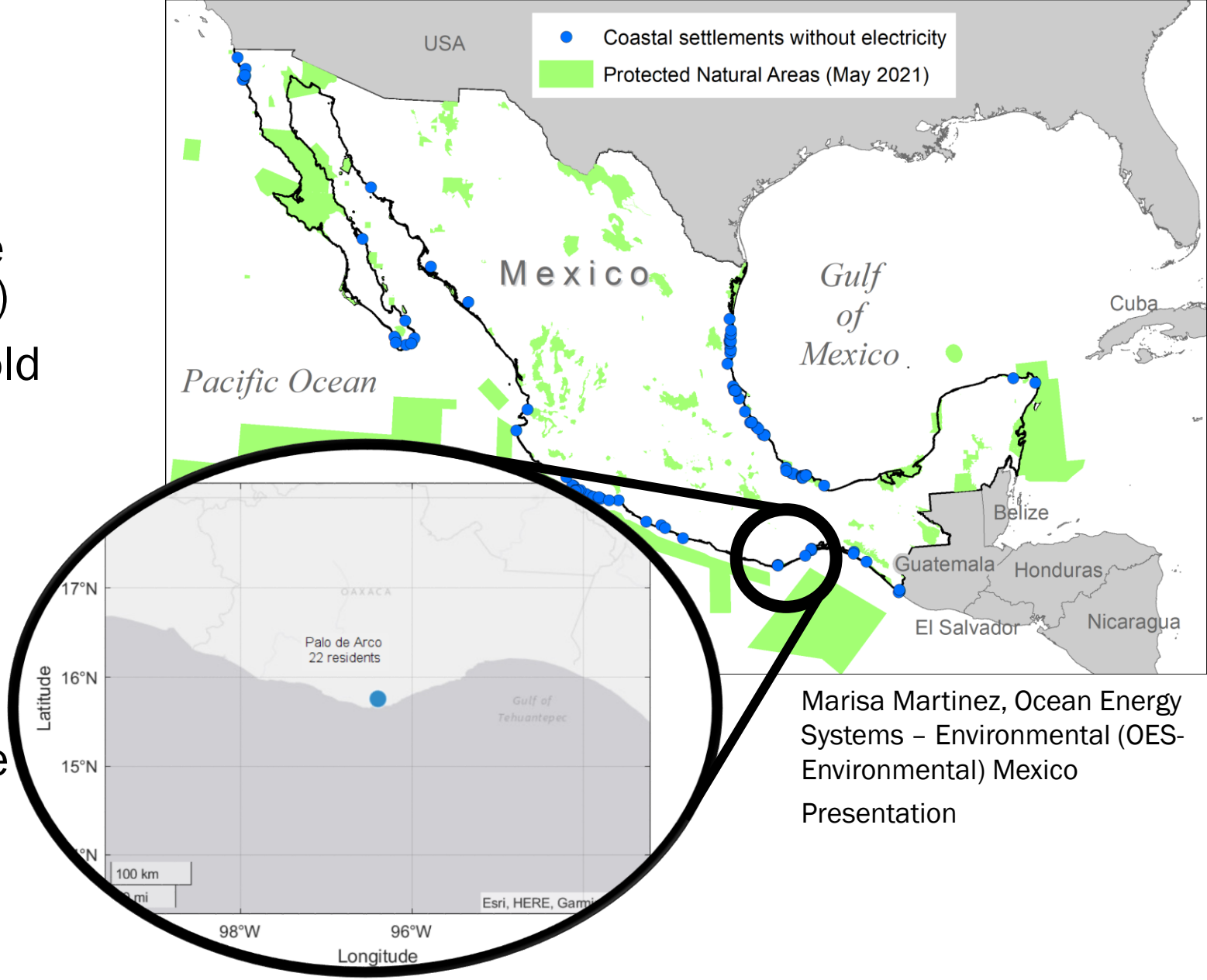
Determine Device Specifications

Example start to technical narrative



Power Requirements

- Electricity usage data are available for nearby Oaxaca de Juarez (Molar-Cruz et al. 2022)
- 100 kWhr/month per household
- Average of 3.7 individuals per household
- Estimated 600 kWhr/month **minimum** required for Palo de Arco (equivalent to ~830W continuous)
- Wave availability was far above 1 kW/m



Marisa Martinez, Ocean Energy Systems – Environmental (OES-Environmental) Mexico

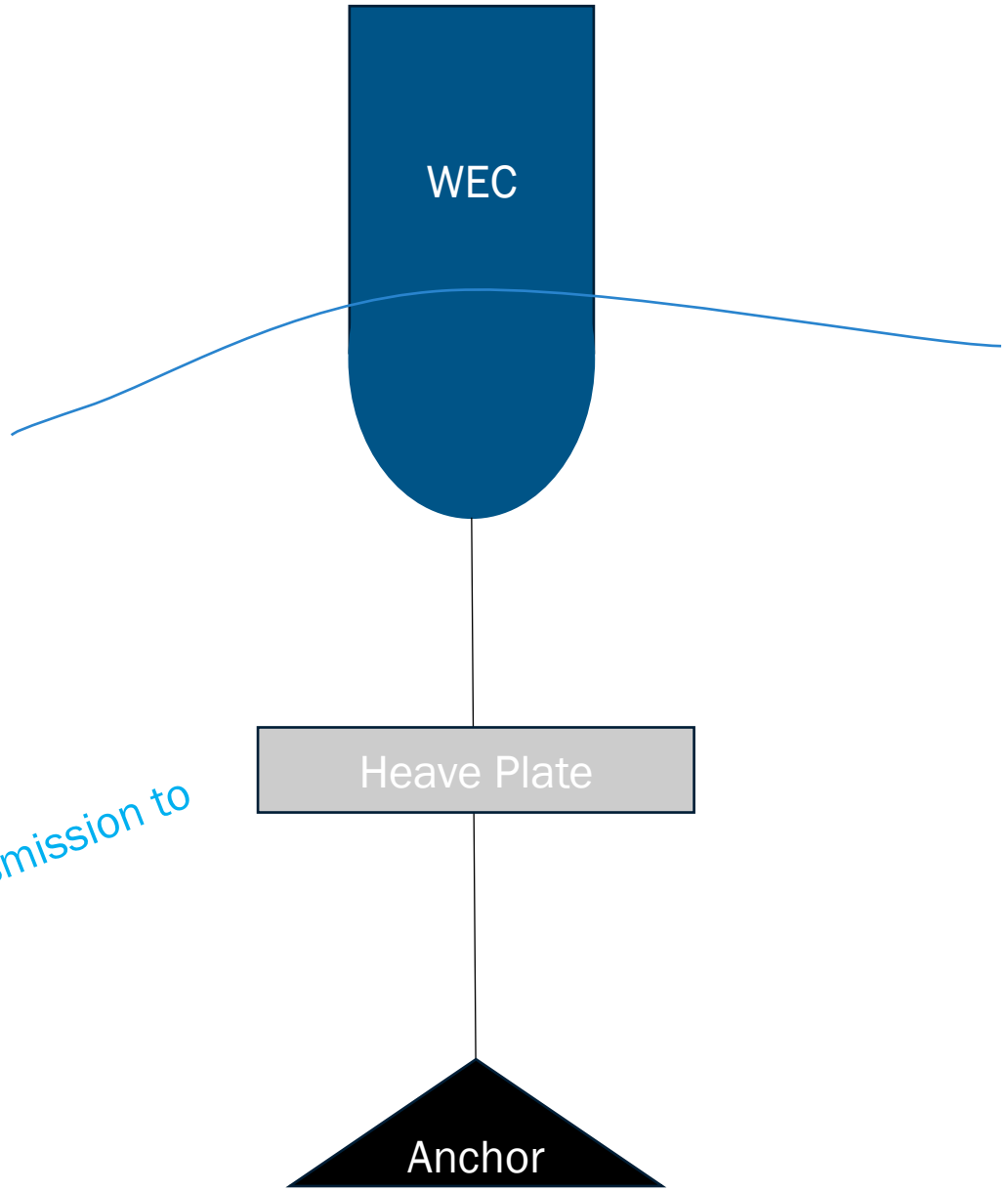
Presentation

Device Archetype

A point absorber is selected

- One of the simplest concepts in system substructures
- Applicable in a wide range of sea states at various deployment sites
- Tend to be smaller and thus more economical and well-suited to small-scale applications

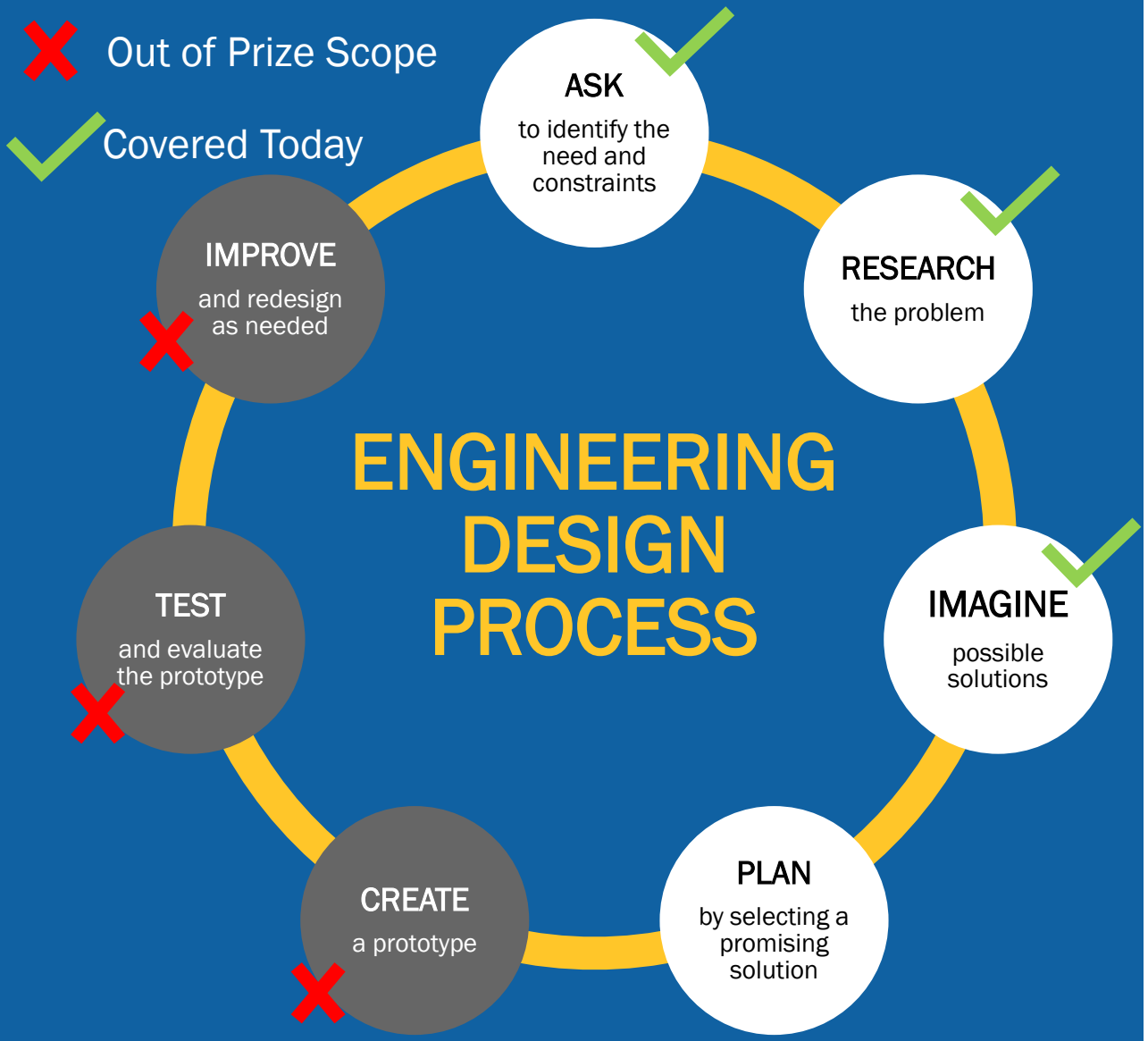
- Assume 40% capacity factor based on documented WECs
- Rated to no less than 2kW



Specifications:
WEC, point absorber, 2kW, transmission to shore

Out of Prize Scope

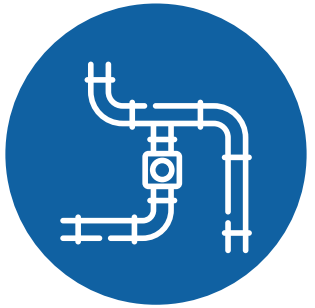
Covered Today



Source: TeachEngineering

- Challenge area: access to electricity (remote community)
- Resource: Wave energy
- Solution: >2 kW point absorber to provide power to Palo de Arco, Mexico

- Next step: Imagine and Plan!



Join the Competition!

Concept Phase Submissions due

July 26, 2024

HeroX.com/poweratseaprize

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Questions