



# Today's Transit for Tomorrow's World

## Hydrogen Fuel Cell Infrastructure

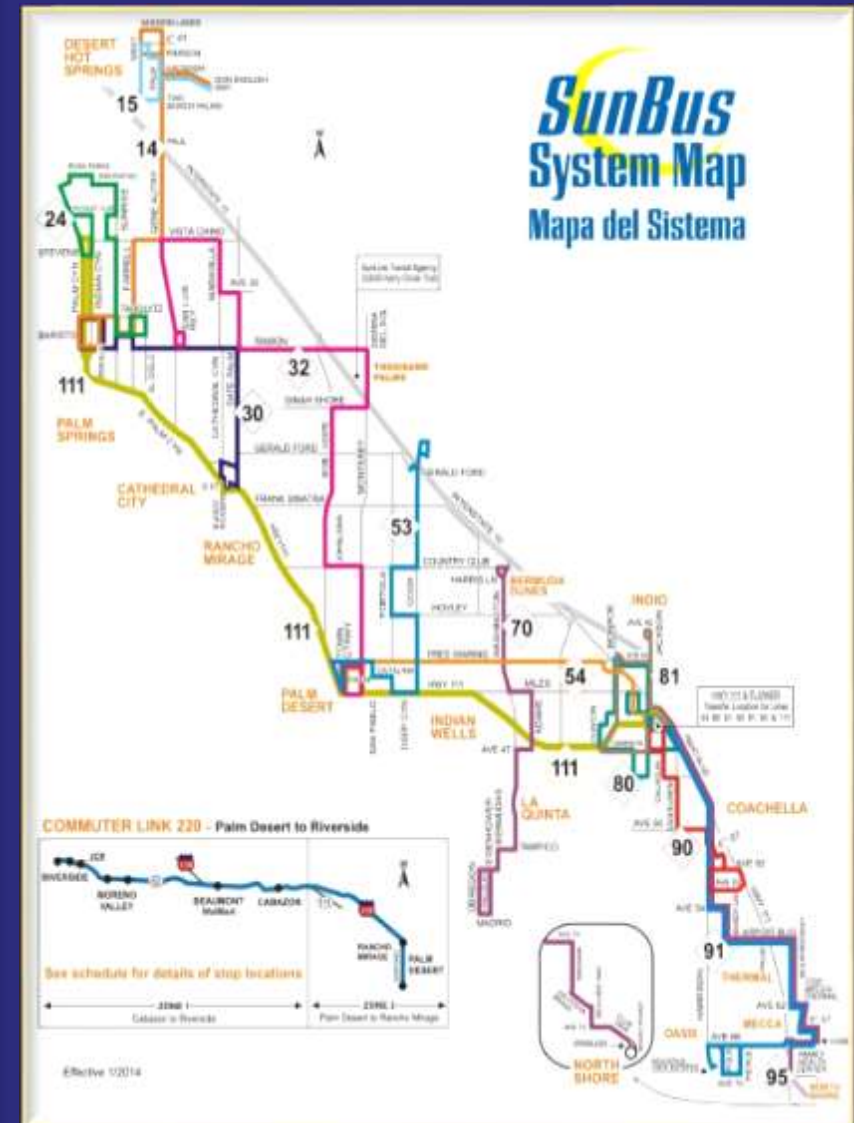
Lauren Skiver  
CEO/General Manager  
SunLine Transit Agency

# SunLine Facts



## SunLine Operations

- Fourteen (14) local SunBus fixed routes, (1) express line, (1) Riverside Commuter Link, ADA Paratransit
- **61 CNG buses**
- **16 Electric Hydrogen Fuel Cell buses (2 more in production)**
- **4 All Electric Battery BYD buses**
- **39 CNG Paratransit Vehicles**
- Operated 4.3 million revenue miles for 4.5 million passenger trips
- **350 Employees**





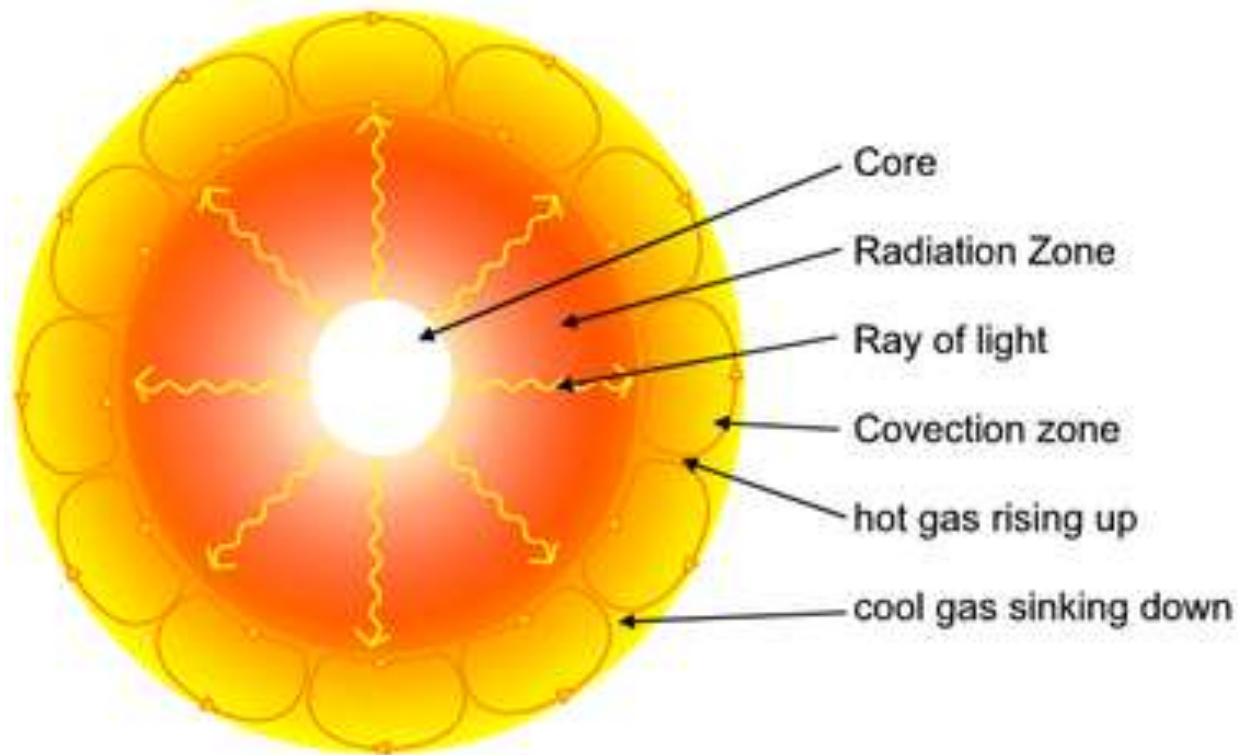
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# What Do You Know About Power/Energy?



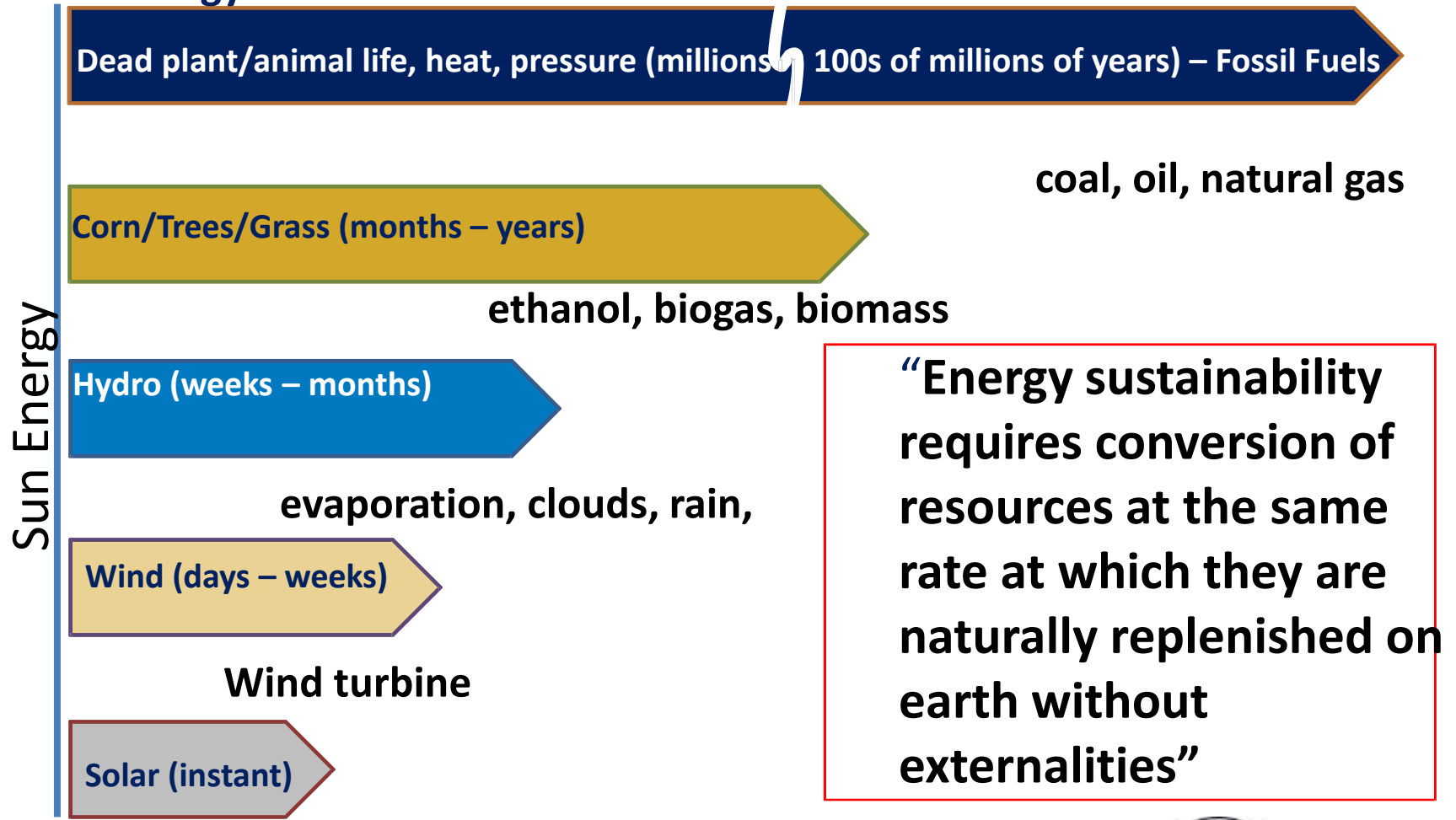
# Powering Planet Earth

Where does every source of power/energy on Earth come from?

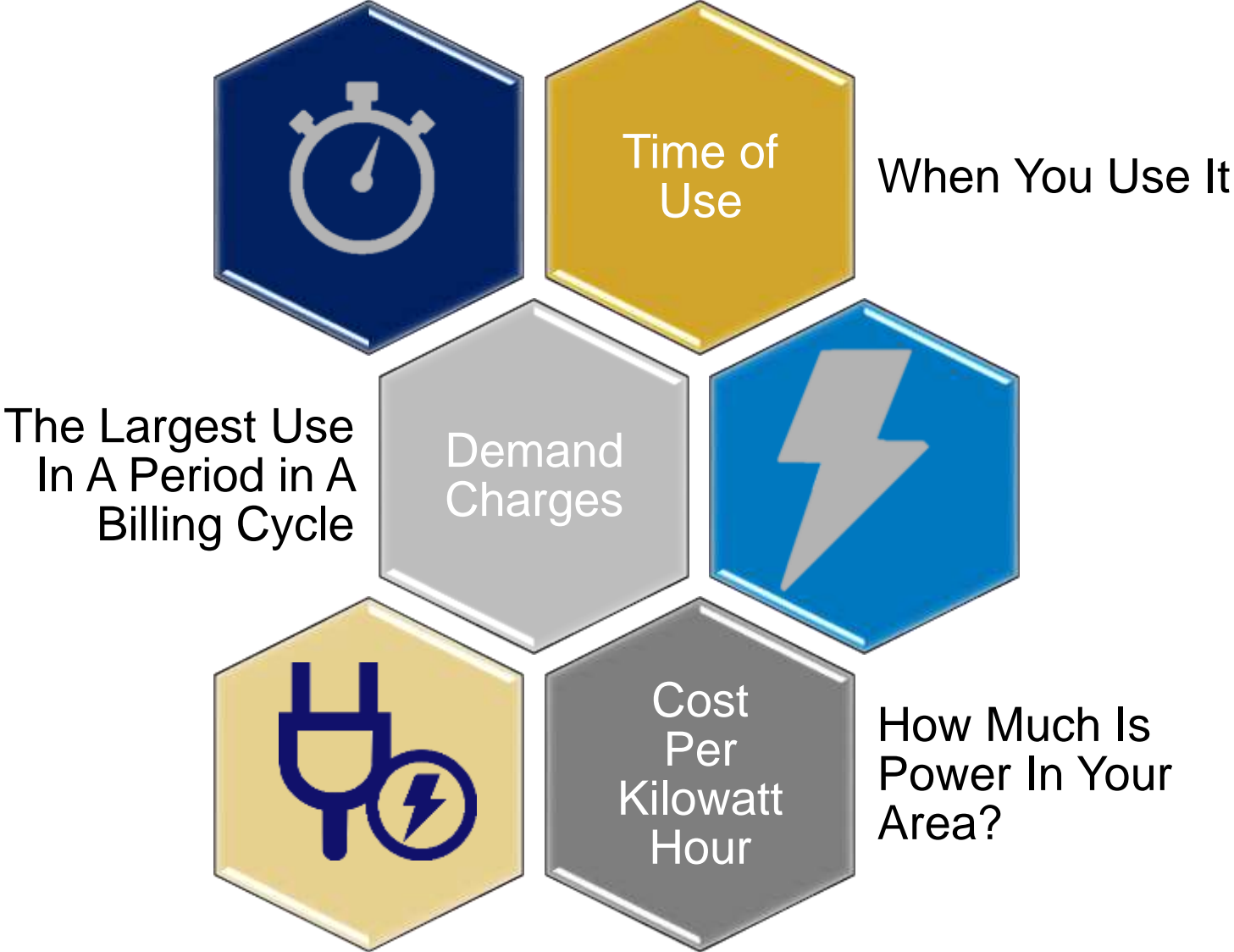


# Primary Energy Sources

All Energy on Earth is from the Sun!



# Electricity Puzzle

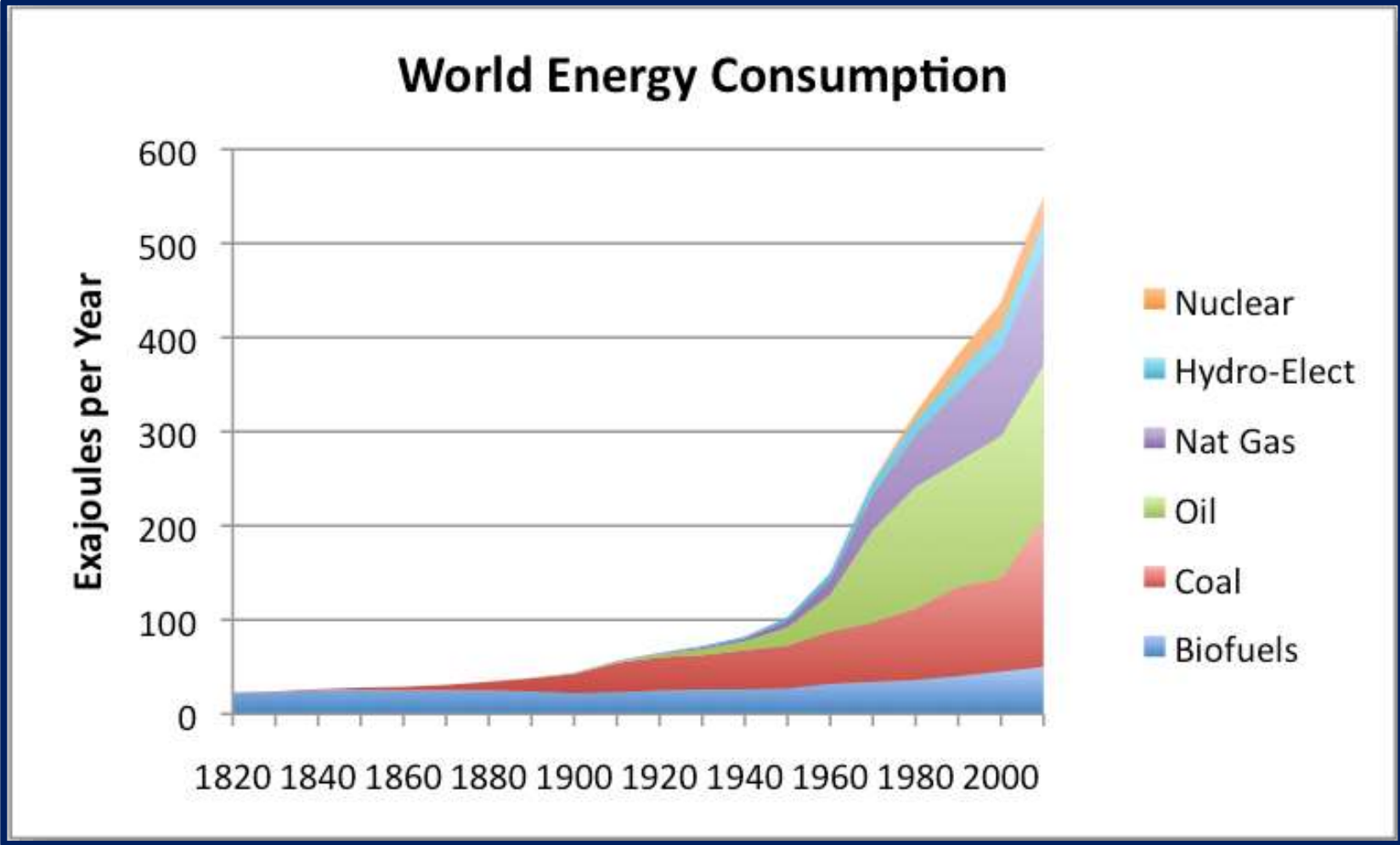


# Electricity Basics



<b>Term</b>	<b>Definition</b>	<b>Composition</b>
<b>Kilowatt Hour – can power a microwave for 1 hour</b>	<b>1 watt of power sustained for 1 hour</b>	<b>Unit of energy equal to 3.6 megajoules</b>
<b>Megawatt – can power approx. 600 homes</b>	<b>1 million watts of power</b>	<b>One megawatt is equal to one million watts, or 1,000 kilowatts</b>
<b>Gigawatt – can power approx. 700,000 homes</b>	<b>1 billion watts of power</b>	<b>Unit of electrical energy equal to one billion (10<sup>9</sup>) watt hours, one thousand megawatt hours</b>
<b>Terawatt – can power approx. 1 billion homes</b>	<b>1 trillion watts of power</b>	<b>There are 1,000,000,000 kilowatts in a terawatt</b>

# Energy Usage Over Time

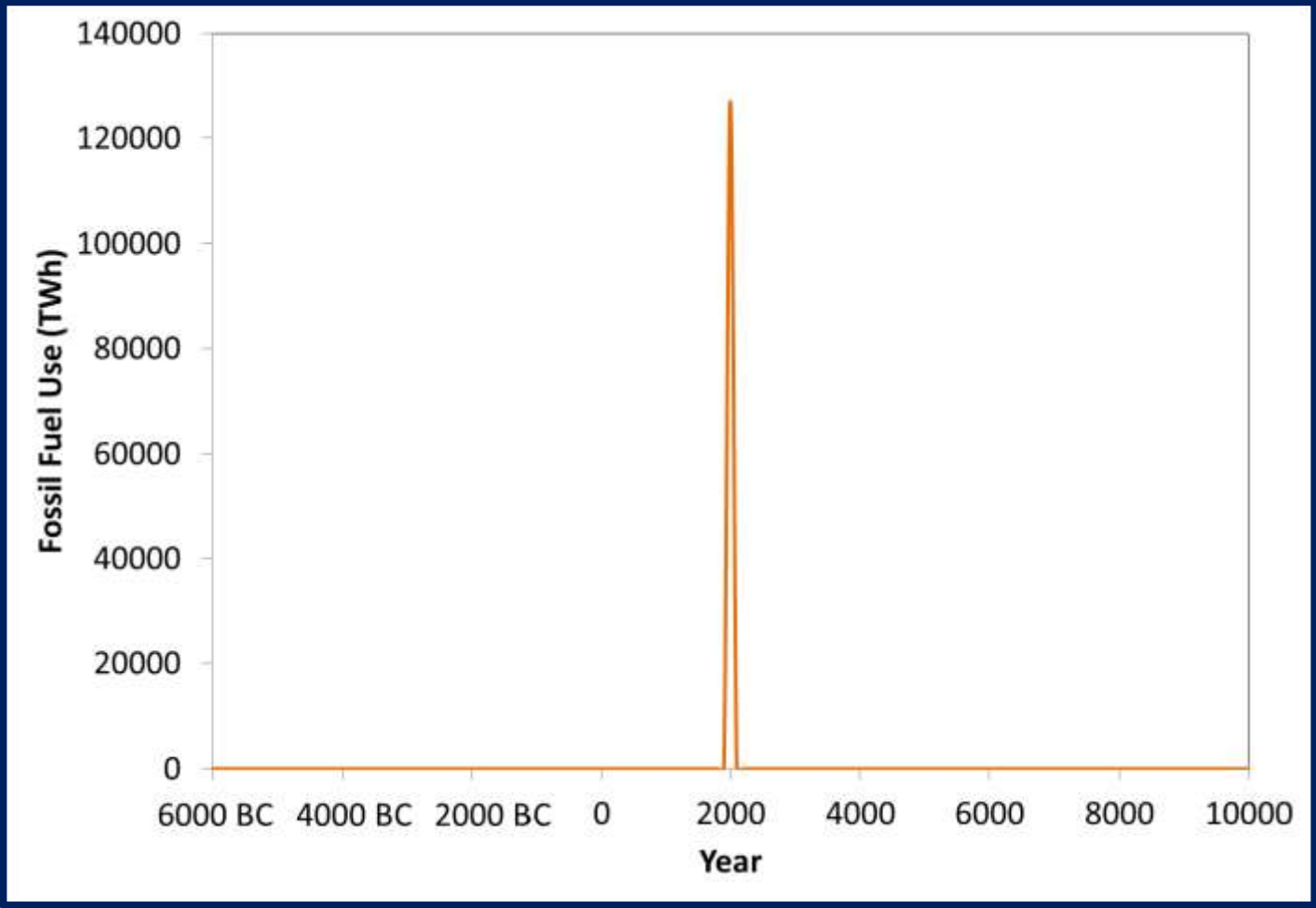




# How Fast We're Burning It



**Current Practices are Obviously not Sustainable**



National Fuel Cell Research Center  
UCIrvine | UNIVERSITY OF CALIFORNIA

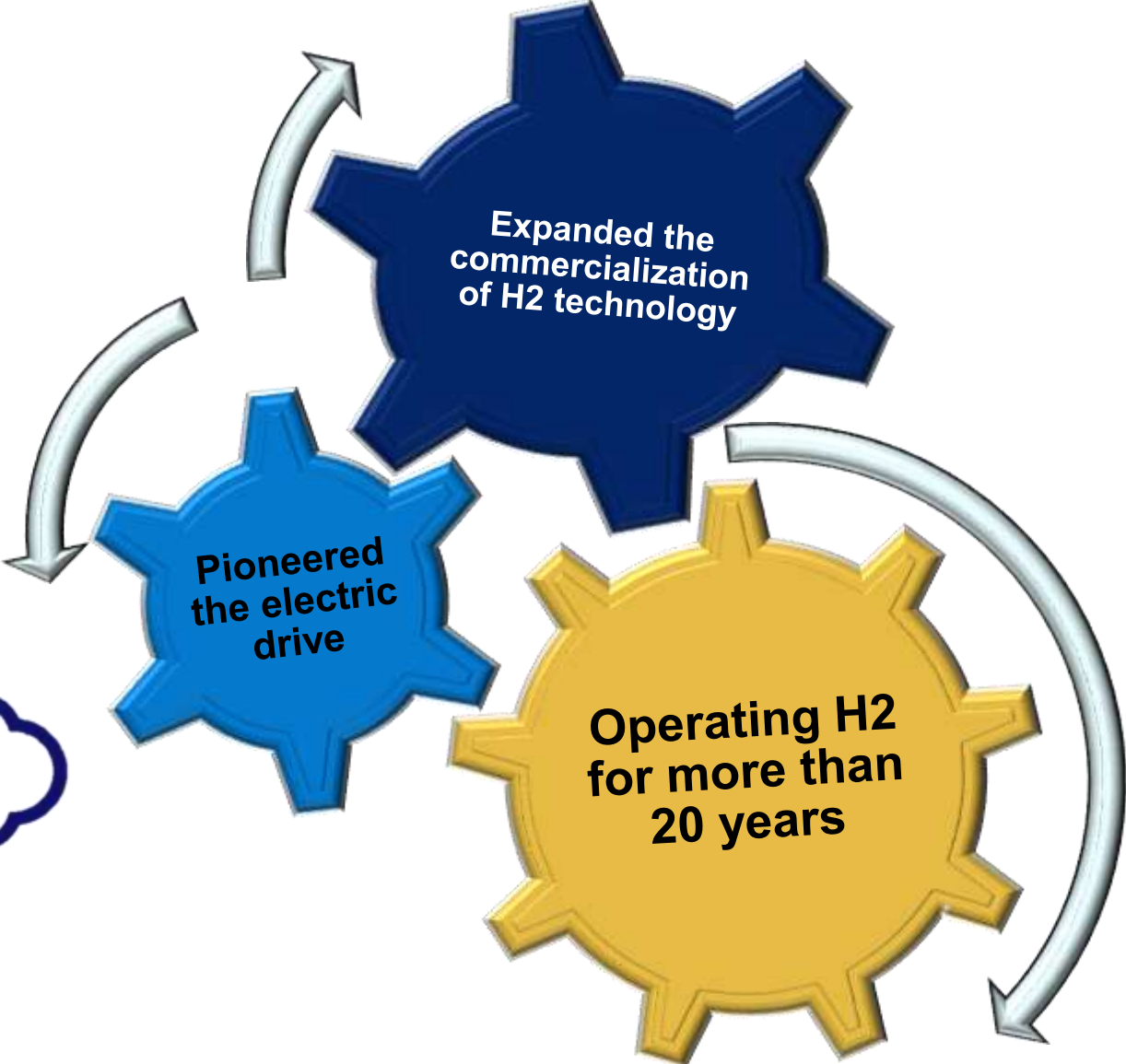


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# SunLine's Hydrogen Program



# SunLine's Hydrogen Program



# Why SunLine Chose Fuel Cell Buses



Fuel cell electric buses are the zero-emission option that can meet SunLine's performance requirements

Daily temperatures can exceed 115° F

Regular scheduled service is between 100 and 200 miles

Combination of rural, highway and city routes

# What Makes Hydrogen Unique?



It can be stored as liquid or gas

It can be created through Steam Methane Reformation or Electrolysis

It can be used to store wind, solar, and other renewables outside of the grid

- The use of renewable source fuel is key to a well to wheel ZEB



# Hydrogen Challenges



## Cost per kilogram can be expensive

- Delivered and at low volumes



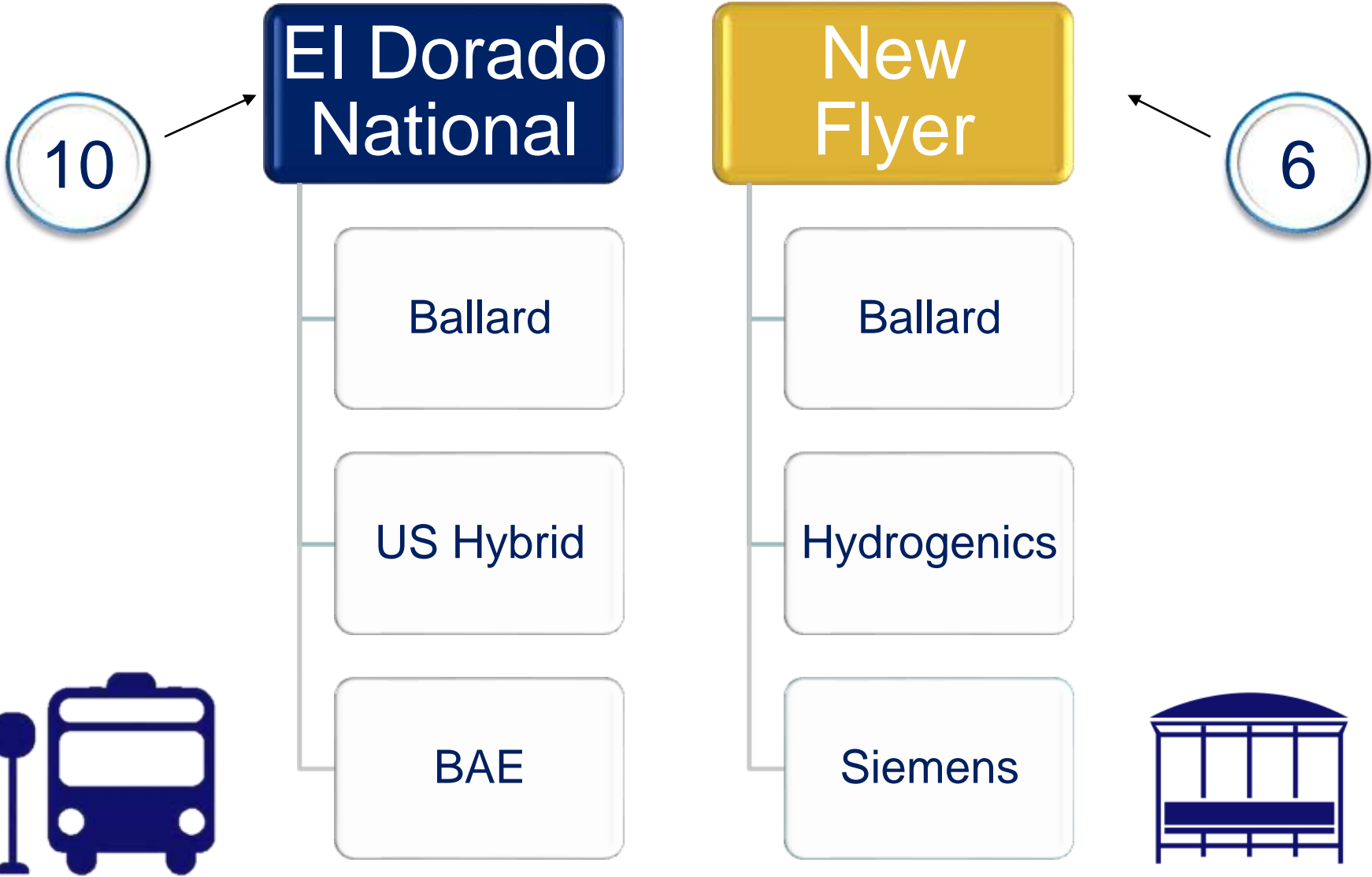
## Station and production plants are expensive



## Agency experience and preparation

- Ask your agency if they believe it works and is good for the agency?
- Take time to train everyone in the organization

# SunLine's Hydrogen Fleet

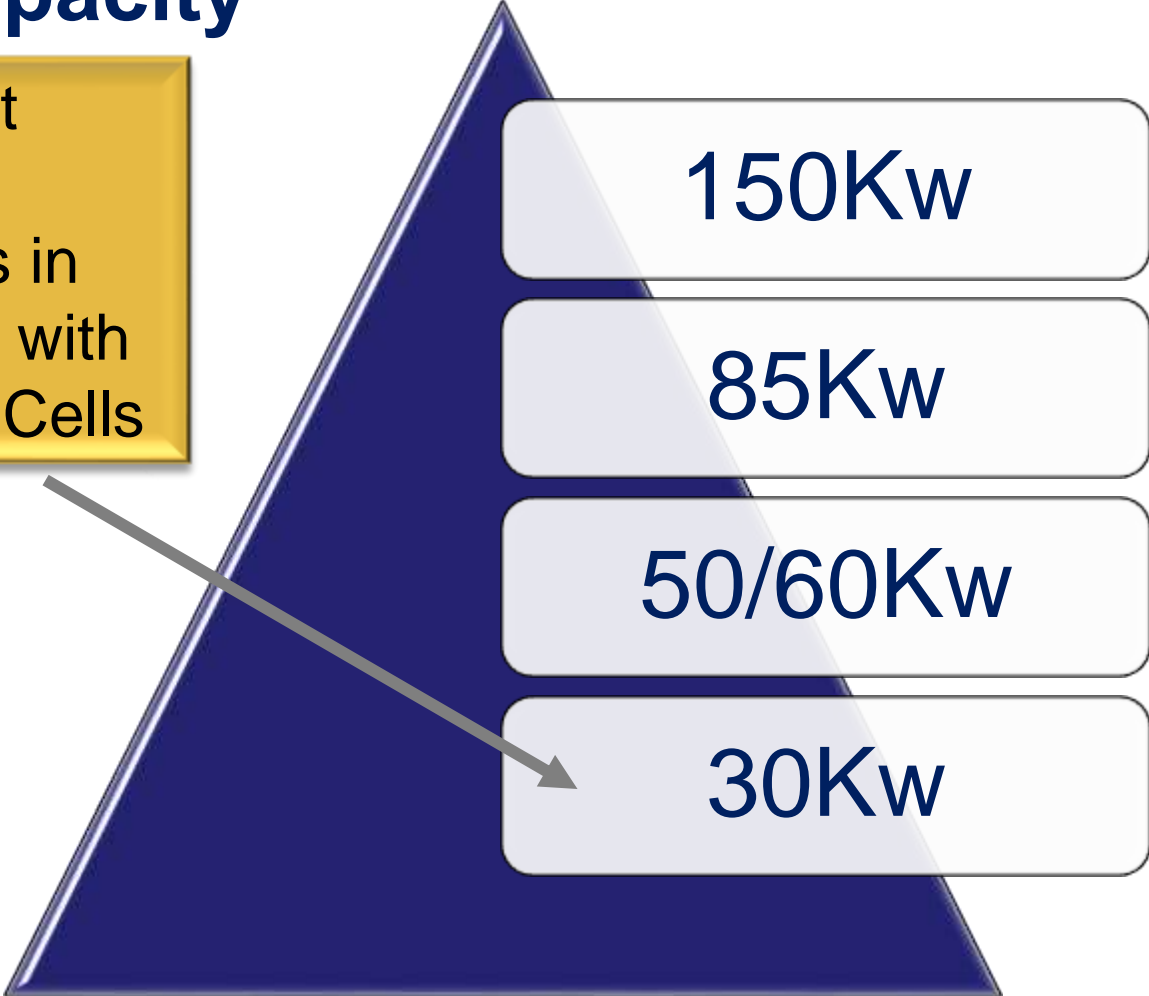


# SunLine's Hydrogen Program



## Fuel Cell Capacity

Two (2) 32ft  
El Dorado  
Shuttle Buses in  
production now with  
US Hybrid Fuel Cells

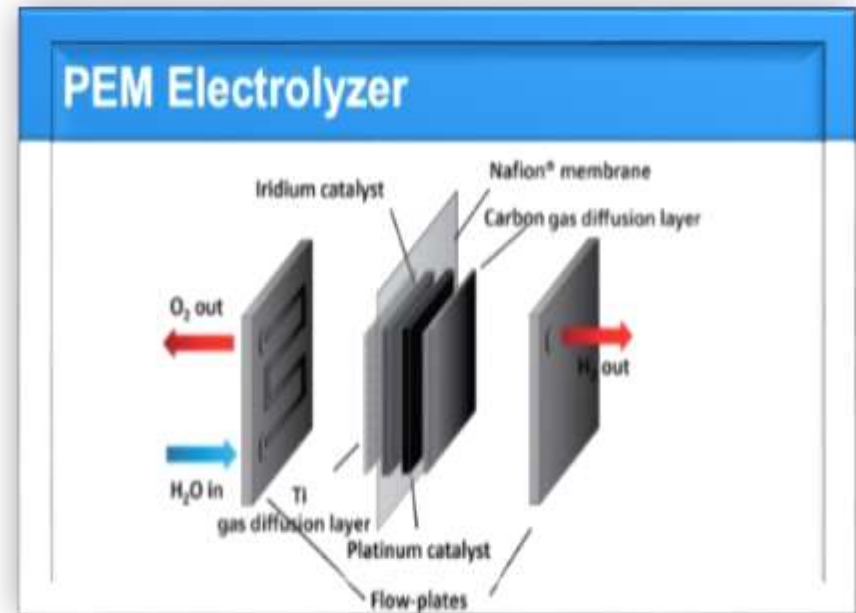




# SunLine's Hydrogen Program

## In Commissioning

- Proton/NeI PEM Electrolyzer
- 900 Kg per day production
- 60% renewable solar electricity
- 380 Kg use per day
- 2 dispenser fast fill rate
- \$8.7 Million CARB Grant
- Public Fueling – 700 Bar expansion for future





# SunLine's Hydrogen Program



## ● Future Fueling Exploration

- SunLine is looking to add a redundancy system that may include liquid Hydrogen or other solution to include outside purchases that are closer to our facilities
- Contracted services for Hydrogen escalate to approx. \$30 Kg
- We would also like to upgrade our second station in Indio for Hydrogen production and outside sales



# Getting Started

## • What should you do to start a ZEB program?

Create a Board Policy

- Most Operators assume Hydrogen is too complicated/expensive for their team and their community

Develop a Mission or Focus on ZEB Technology

- Ensure that the agency knows what and why leadership is directing change a in platform
- Develop internal champions who are emerging leaders and believe in the benefits of piloting new technology

Redesign Your Existing System

- We have to “stop selling, what riders aren’t buying”
- Plan your new network using ZEBs
- Many agencies are looking at more frequent, reduced running times and more productive services

Manufacturer / Operator Relationships

- Ensuring all parties understand risk and work together to solve problems

# West Coast Center of Excellence



# Completed Training Modules



Advanced Technology  
Technician Training



Procurement Insights  
for ZEB purchases



Planning and executing  
ZEB's in service



Leadership, mission,  
value creation for a  
successful ZEB  
Program

# Key Takeaways



SunLine has made a deep commitment to reducing environmental impacts while delivering world-class transit services



The Hydrogen Fuel Cell Option is absolutely available



SunLine does not use any solid fuel to deliver transit to the Coachella Valley



Zero emission technology works



California's Innovative Clean Transportation Rule is a game-changer for the clean fuels industry

# Thank You



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