

The background image shows a wide-angle view of a modern architectural complex at TU Delft. In the center, a large, grey, conical structure with a metal lattice top rises against a clear blue sky. Below it, a wide, multi-level concrete staircase with many steps leads down a grassy slope. Numerous people are sitting and walking on the stairs and the grass. To the right, a green lawn slopes upwards towards a modern building with a glass facade. The overall scene is bright and sunny, with lush green trees visible in the distance.

# Why Hydrogen?

Prof. Dr. Ad van Wijk

14-12-2017

# Third wave renewable energy

World wide, large scale cheap  
renewables  
Fully renewable energy system

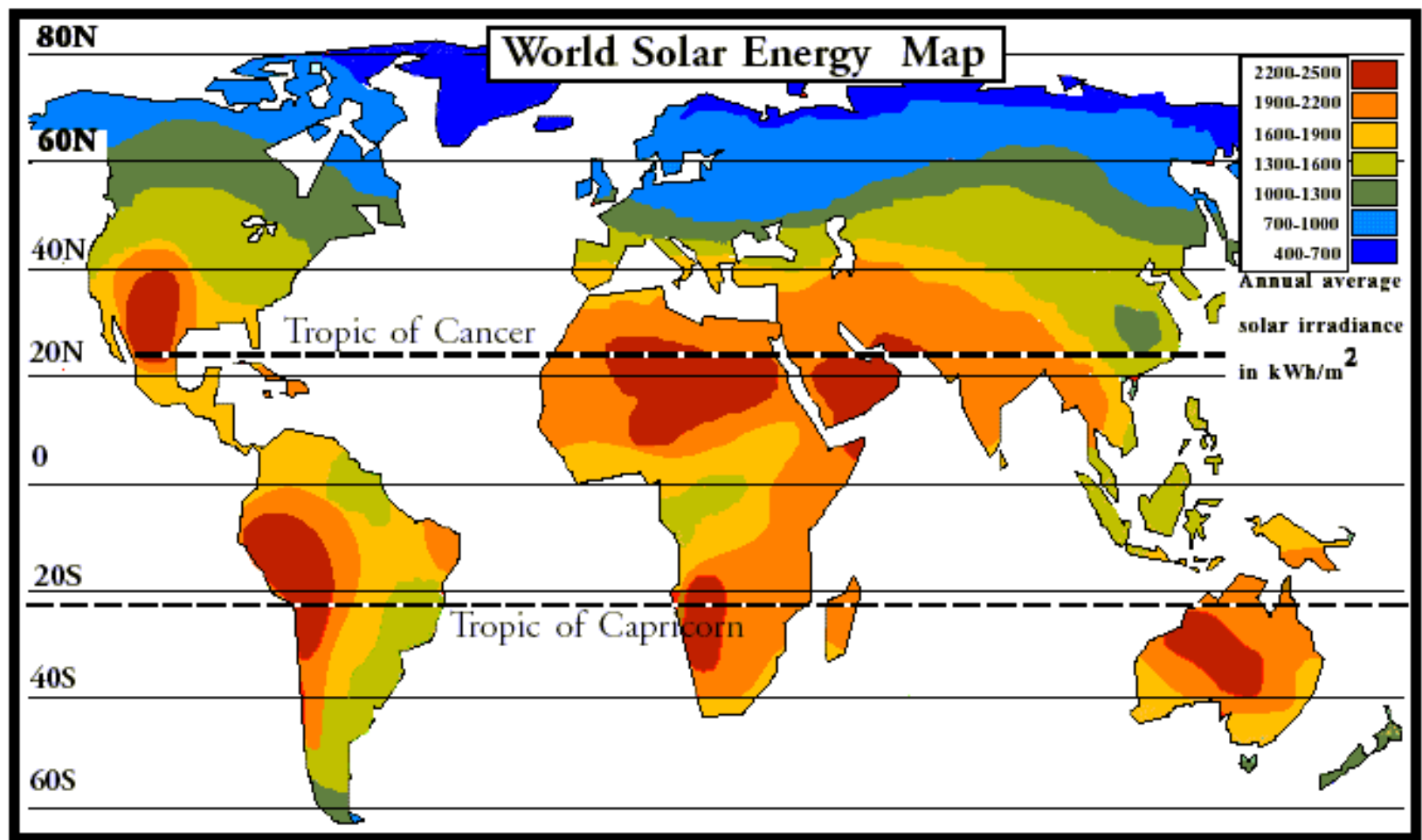
Local, renewable  
energy in fossil  
energy system

Technology  
Development

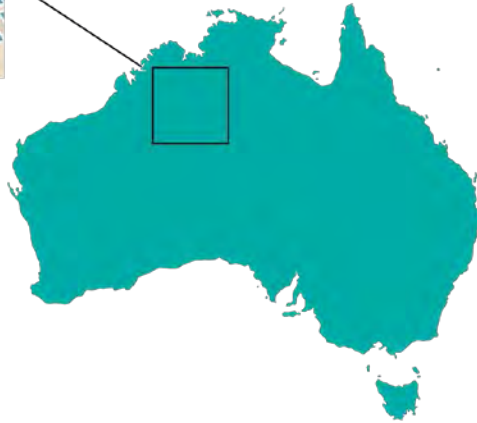
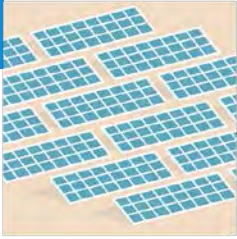


# Bids for Saudi Arabia's 300 MW Solar Plant

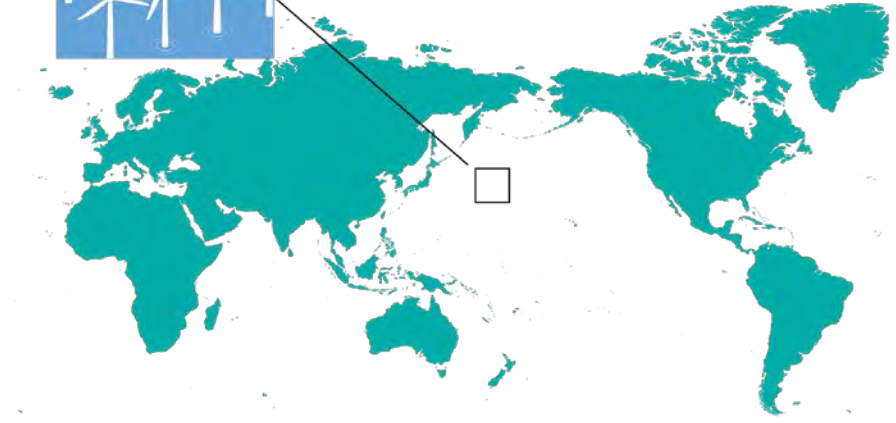




# Surface needed to produce all the world's energy 556 EJ = 155.000 TWh



10% SOLAR AUSTRALIA

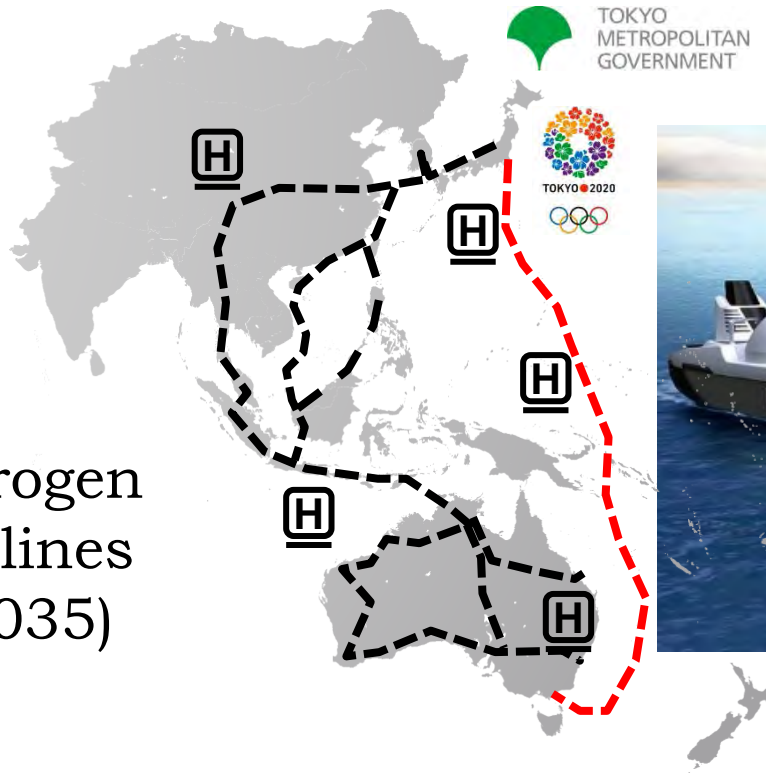


1.5% WIND PACIFIC OCEAN

# Tokyo Olympic Games 2020



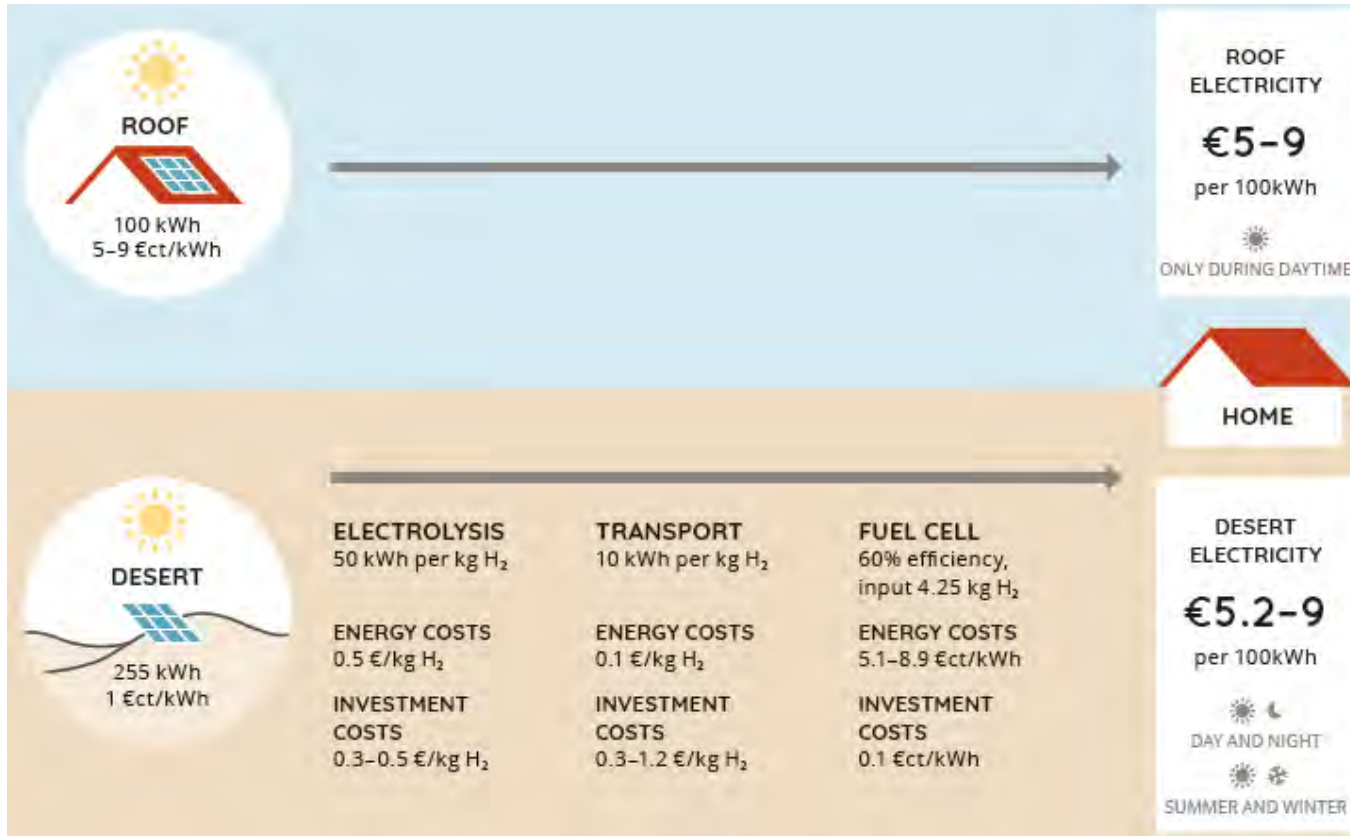
Hydrogen  
Pipelines  
(~2035)



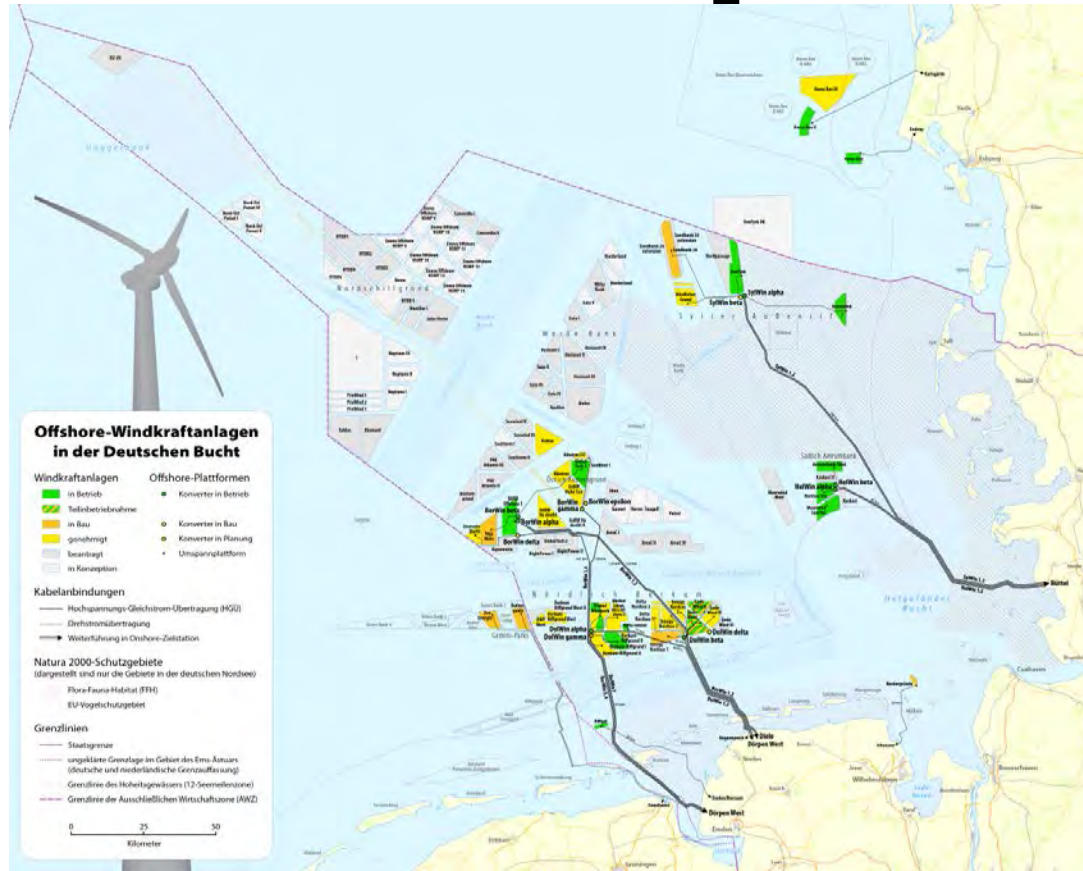
Hydrogen  
Shipping  
(~2025)



# Roof versus Desert Solar



# Offshore Wind Development Germany



# Eemshaven; The Energy Harbor



Norned Cable 700 MW

Cobra Cable 700 MW (2019)

Gemini Offshore Wind Farm 600 MW

Onshore Wind Farms > 275 MW

Nuon Magnum power plant 1,320 MW

RWE Coal fired power plant 1,560 MW

Engie Gas fired power plant 2,450 MW

Cable Inland 4,000 MW

Expansion to 5,610 MW

# Electricity and Gas Transport Grid

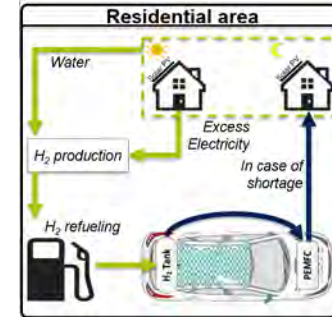


# Green Hydrogen Markets

## Chemical Feedstock



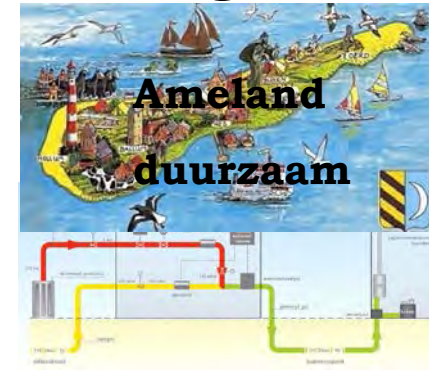
## Electricity Balancing



## Transport

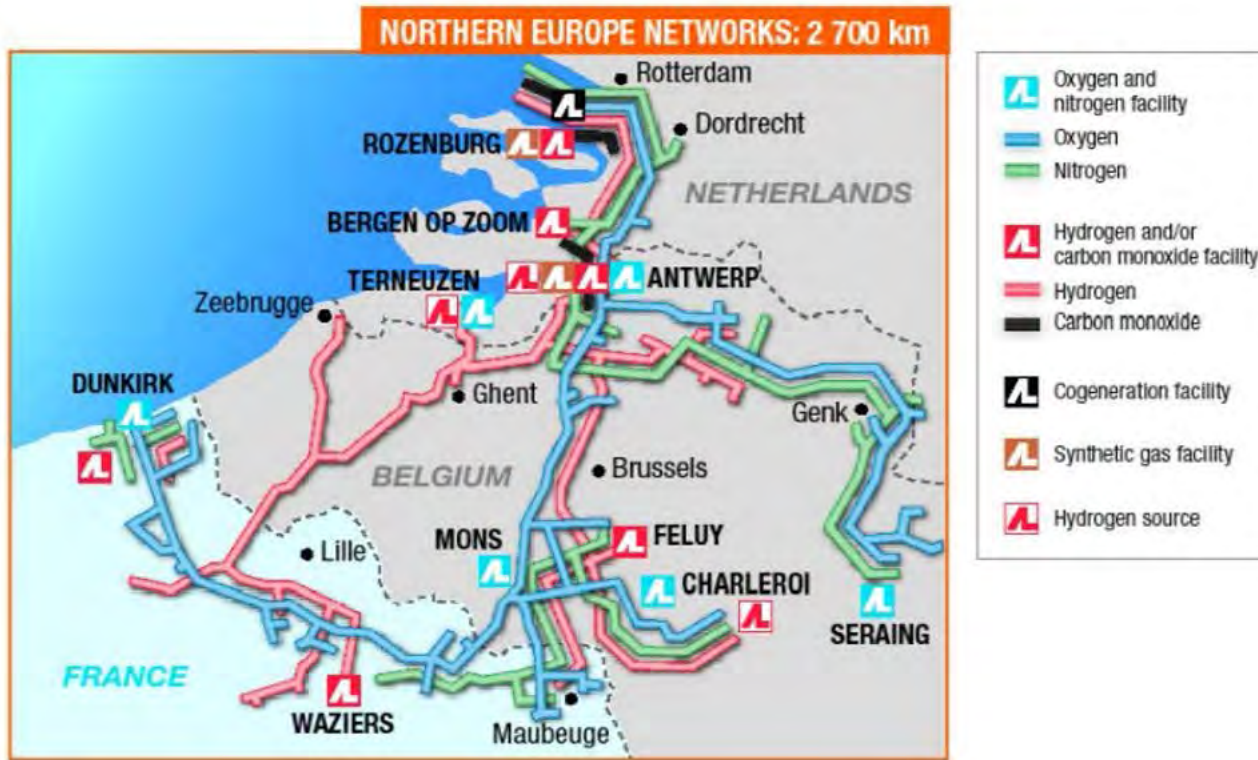


## Heating

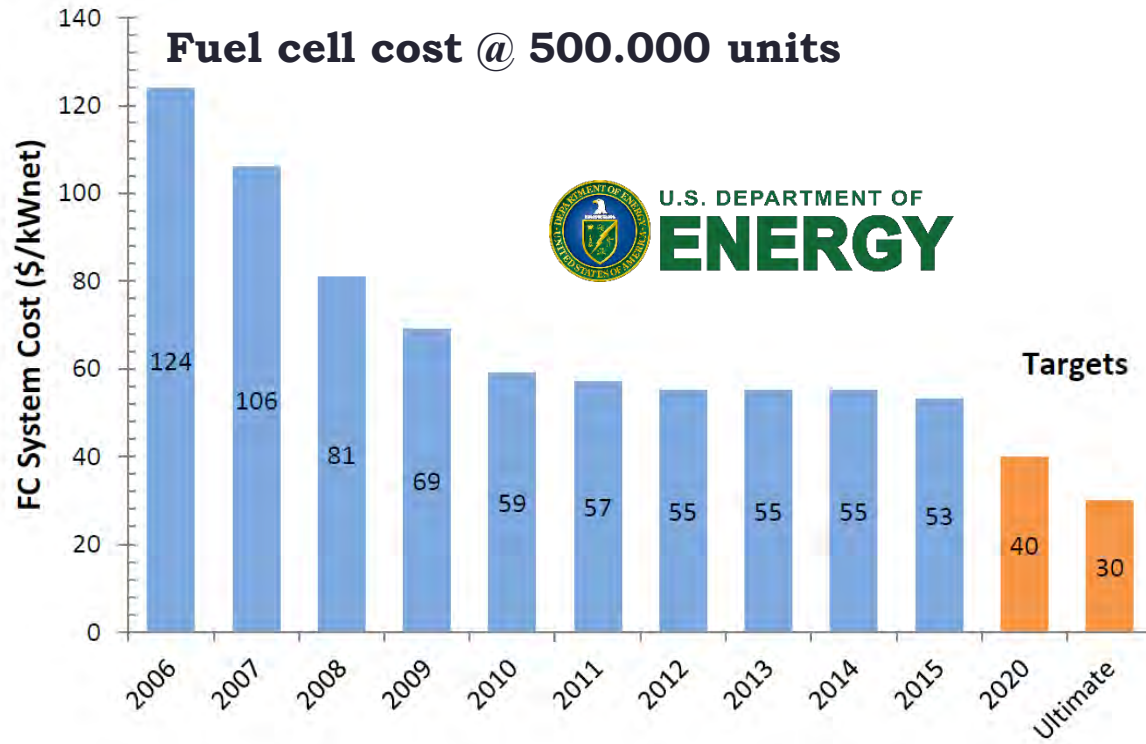


# Hydrogen Pipelines

## Netherlands-Belgium-France



# Fuel cell cost



**TOYOTA**

2008 FUEL CELL STACK

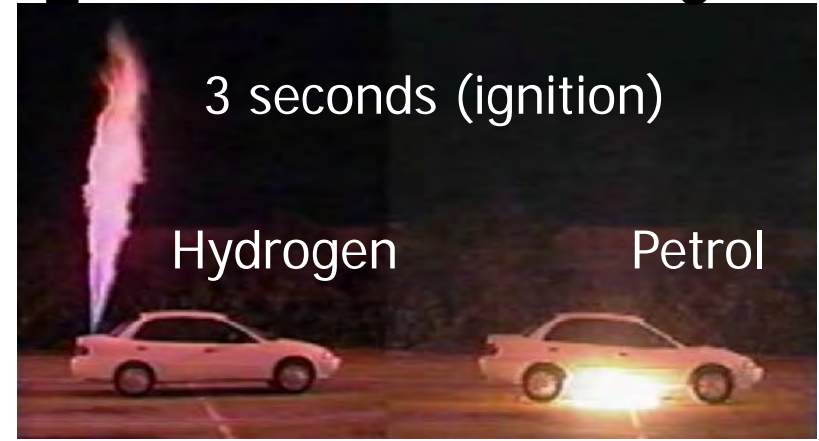
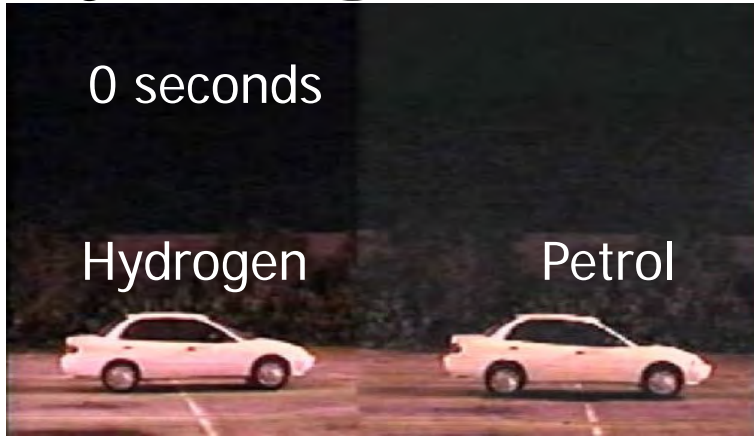


Weight **-48%**    Volume **-43%**    Power **+26%**



2016 FUEL CELL STACK

# Hydrogen versus petrol safety



# Defying Death Valley

