

# Environmental challenges of the Swedish road ferries



FÄRJEREDERIET  
TRAFIKVERKET

# Färjederiet, part of Swedish Transport Administration

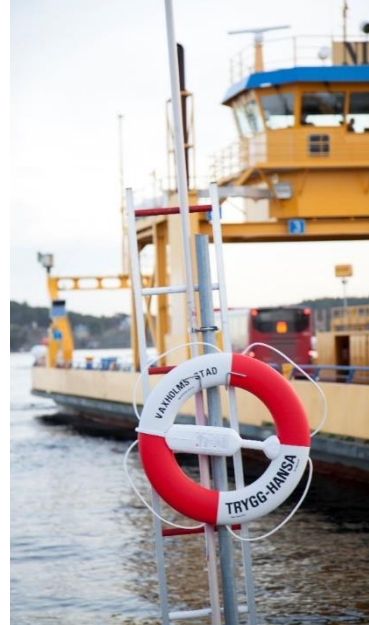
70 road ferries

41 routs

1 million port of calls

13 million transported cars

22 million pax



FÄRJERERIET  
TRAFIKVERKET



FÄRJEREDERIET  
TRAFIKVERKET

# Goal

## Zero CO2 emission year 2045



FÄRJEREDERIET  
TRAFIKVERKET

# HVO

## Hydrogenated Vegetable Oil



FÄRJEREDERIET  
TRAFIKVERKET

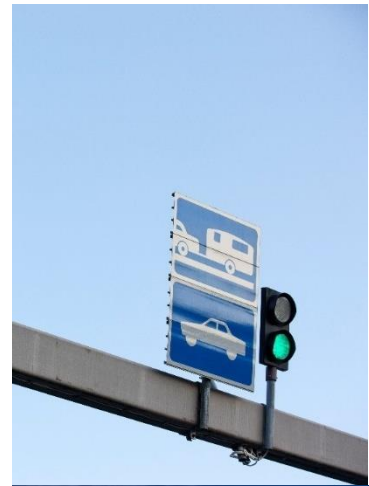
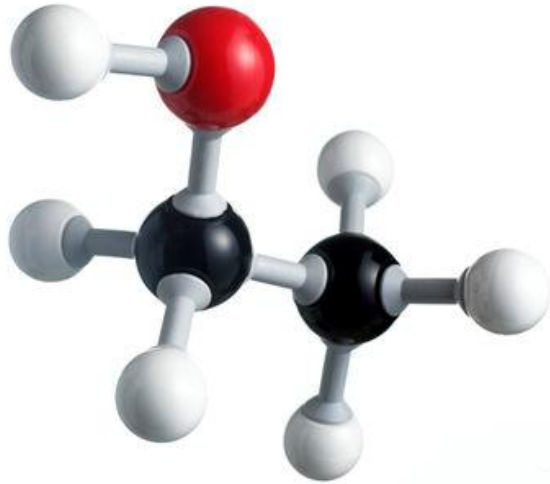


# Bio Methanol

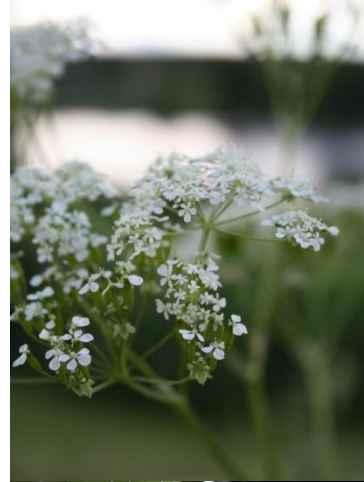


FÄRJEREDERIET  
TRAFIKVERKET

# Ethanol



# Bio Gas

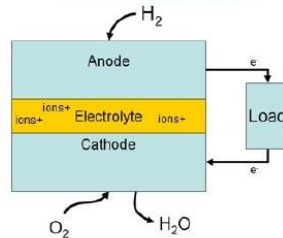




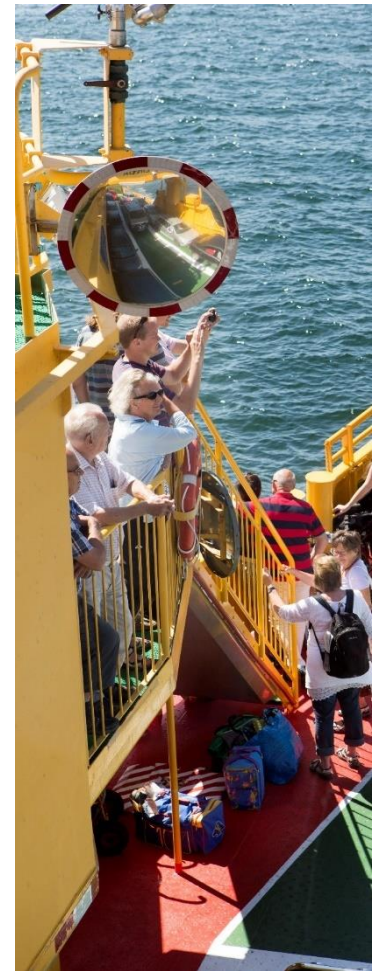
# Fuel cells

## What are Fuel Cells?

- Battery that produces electricity
- overall reaction: oxidation of a fuel by oxygen
  - $2\text{H}_{2(g)} + \text{O}_{2(g)} \rightarrow 2\text{H}_2\text{O}_{(l)}$   
(Hydrogen) Fuel + oxygen  $\rightarrow$  water
- Unlimited fuel supply: reactants continuously supplied from an *external source* (open system)
  - Also known as *flow battery*
- Used as a stack



# Battery and hybrids



FÄRJEREDERIET  
TRAFIKVERKET

# Six electrical ferrys



FÄRJEREDERIET  
TRAFIKVERKET





# Conclusions?



FÄRJEREDIET  
TRAFIKVERKET