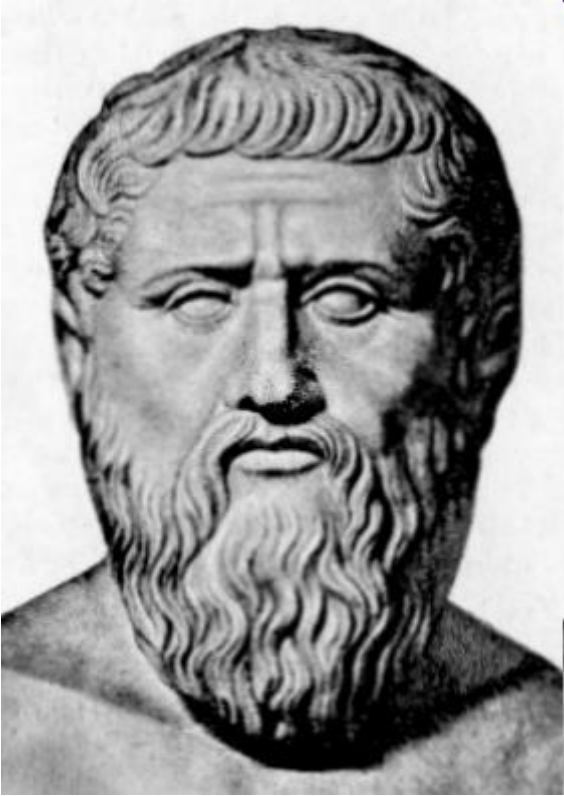




# Clean CHORUS Energy *cluster*



# The Challenge of Sustainable Development



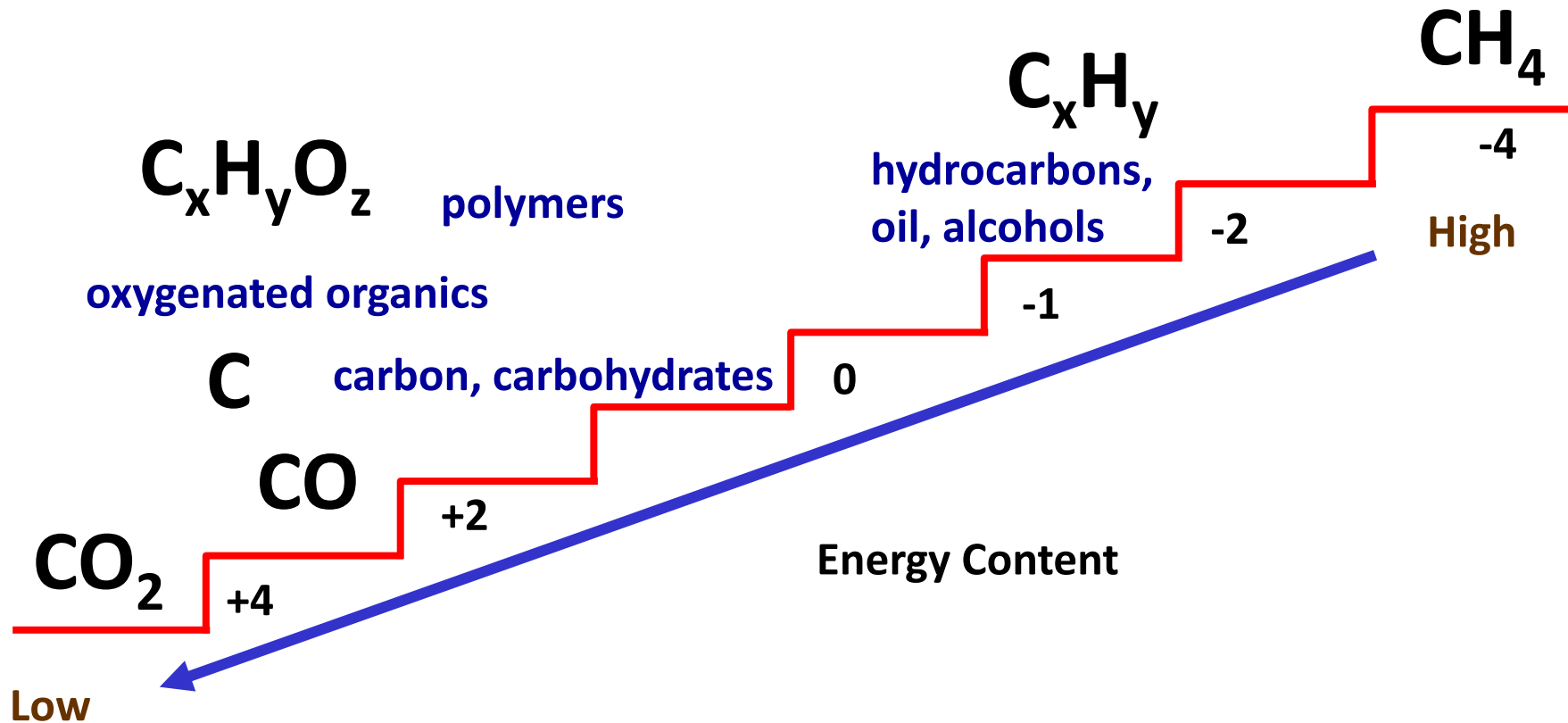
*“...γῆ μὲν ὀπόση πόσους σώφρονας ὄντας  
ἰκανὴ τρέφειν, πλείονος δὲ οὐδὲν  
προσδεῖ...”*

*Πλάτων, Νόμοι, 360 π.Χ.*

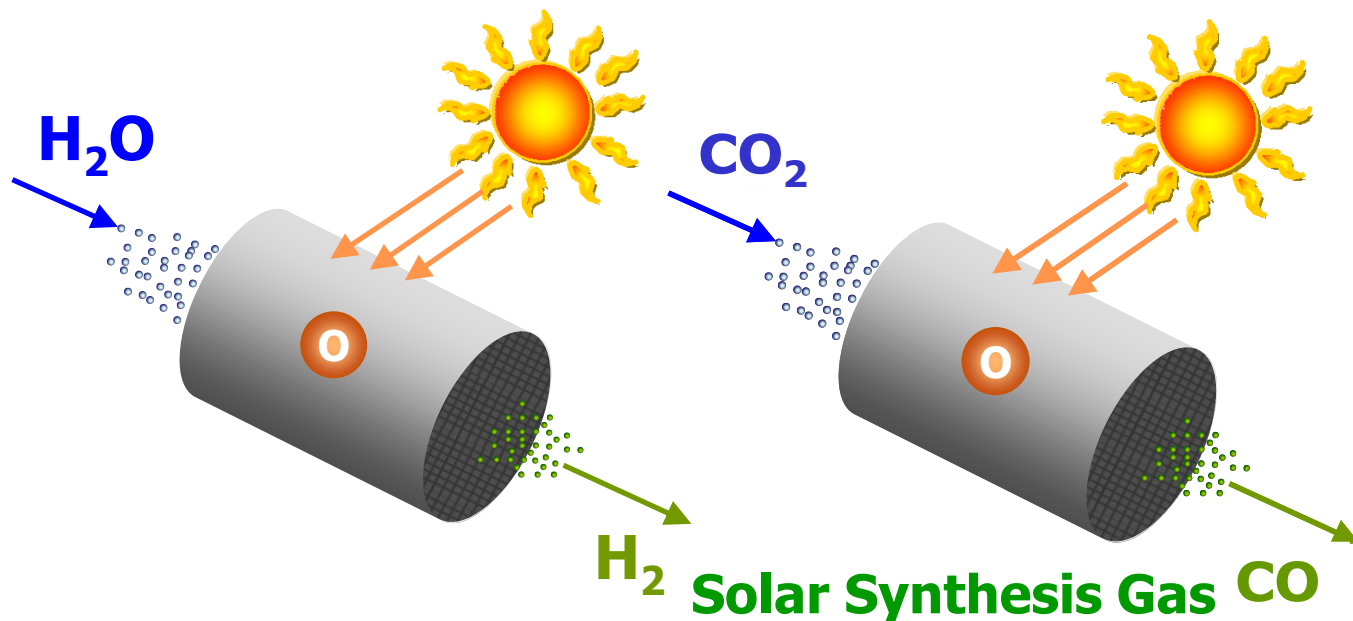
*“...The land must be sufficient to  
support no more than a certain number  
of people living with moderation...”*

*Plato, Laws, 360 B.C.*

# Stairway to (Energy) Heaven



# Clean Energy & Materials from Sun, H<sub>2</sub>O & CO<sub>2</sub>

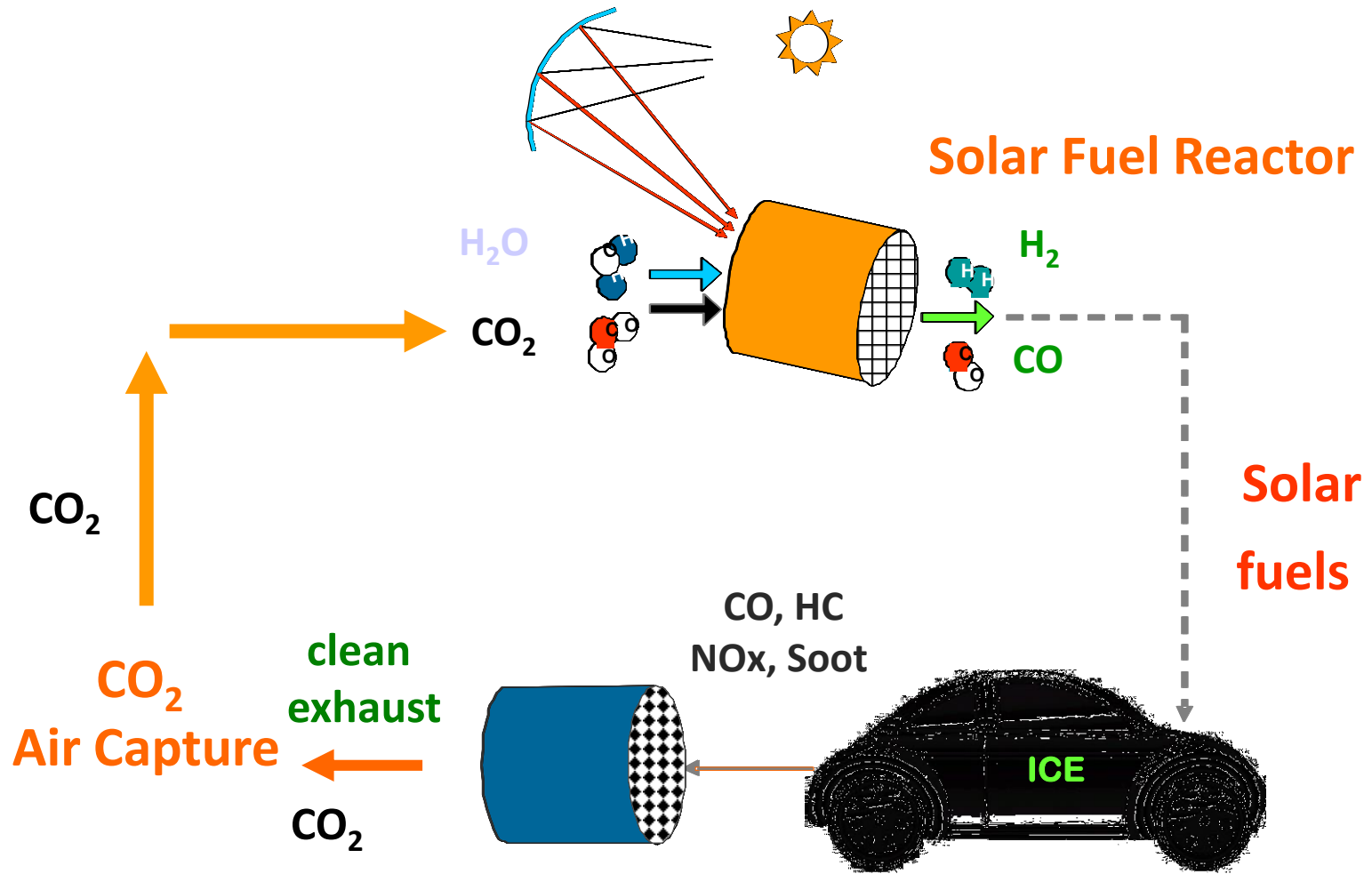


**Sustainable Storage of Carbon AND Hydrogen!**

# What is CHORUS?

The **CHORUS Clean Energy Cluster** brings together companies and research entities in order to establish an arsenal of renewable and zero / low carbon footprint technologies, transformable into innovative, integrated products and solutions for the global Clean Energy and Green Mobility markets.

# Vision: Sustainable Mobility and Clean Energy



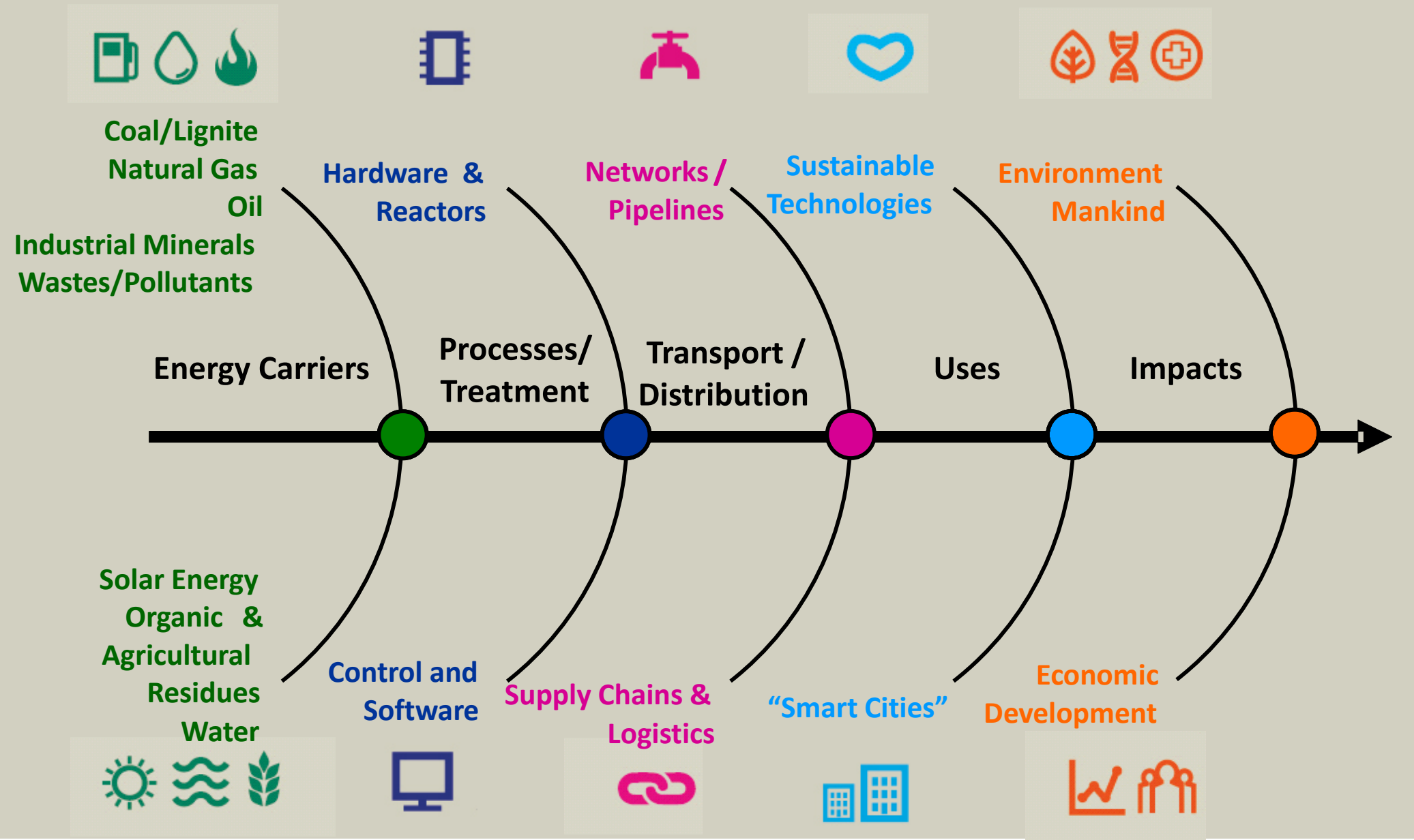
**Multifunctional  
Emission Control Reactor**

# CHORUS Target Companies/Organizations

- have a range of **technology products and solutions** that are relevant for the development of clean energy, including **low carbon energy, renewable energy and energy efficiency**
- are **heavy energy users** and could use clean energy technologies and solutions with other products and services that are relevant for the development of **innovative integrated clean energy solutions**, such as logistics, information technologies, etc.
- can provide services in the areas of **networking, knowledge transfer, business incubation and innovation financing**

# Driver: The Concept of the Energy Corridor

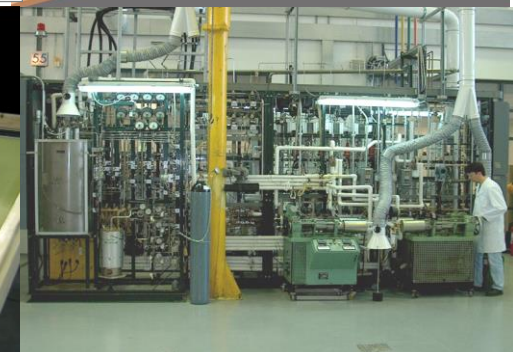
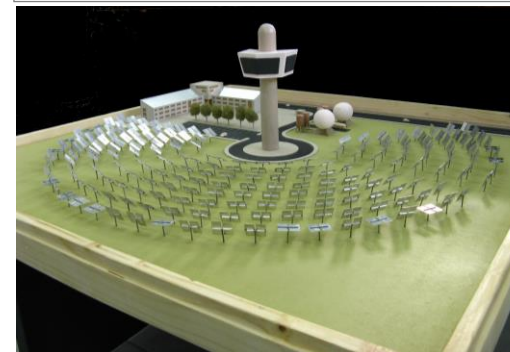
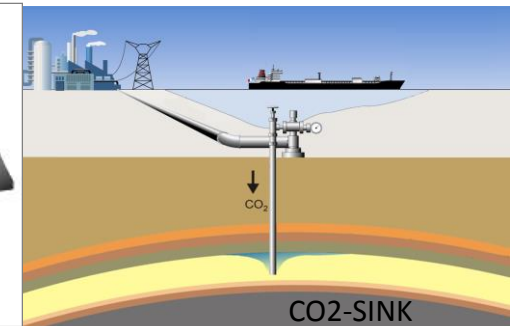
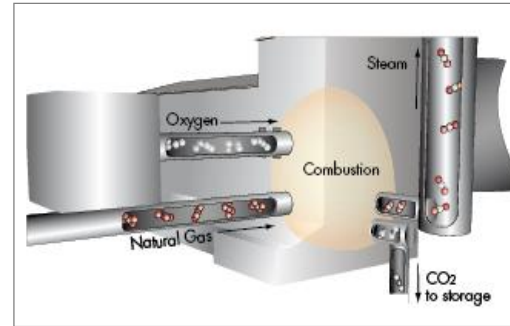
## A Holistic Approach to Sustainability





# Some Representative Technologies

- CO<sub>2</sub> emissions reduction (energy efficiency, capture and management/reuse of CO<sub>2</sub>)
- Zero/Neutral Carbon Fuels (biofuels/biorefinery, solar fuels)
- Sustainable transport (Green mobility)
- Smart Grids, Smart environments, Smart neighborhoods/cities
- Tools for Mapping the Exposome



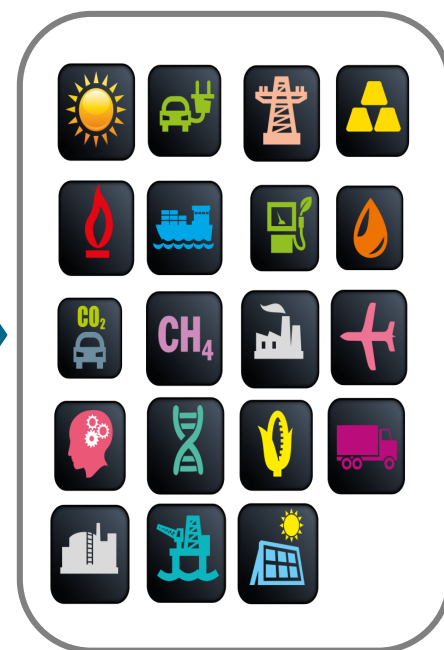
# CHORUS Clean Energy Cluster



## KNOWLEDGE CREATION & TRANSFER



## NOVEL PRODUCTS & MARKETS



RENEWABLES / LOW CARBON ENERGY SOURCES

ENERGY EFFICIENCY/EMISSION CONTROL

# CHORUS – Backbone for Smart Growth

## Regional Innovation and Smart Specialization



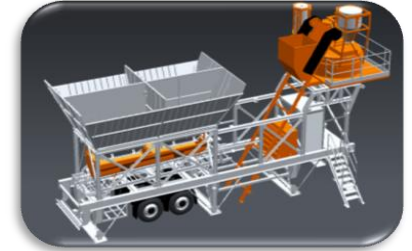


# CHORUS Company Members



# Examples of New Products and Technologies

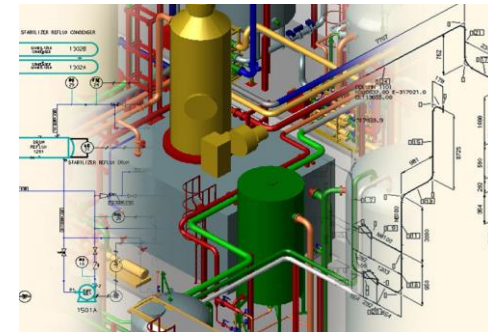
- Autonomous Waste Treatment and Heat Recovery Mobile Plant (SPANOS, COMPUCON, ESTIA)
- Smart retrofit emission control systems (COMPUCON, EVIEX)
- Electric Vehicle Charging Stations (ENGAIA, EXELGROUP, HELPE RES)



- Autonomous solar-fuel plant (ENGAIA, EXELGROUP, EVIEX, HELPE RES)
- Low Carbon Footprint Cement Processor (SPANOS, EVIEX)

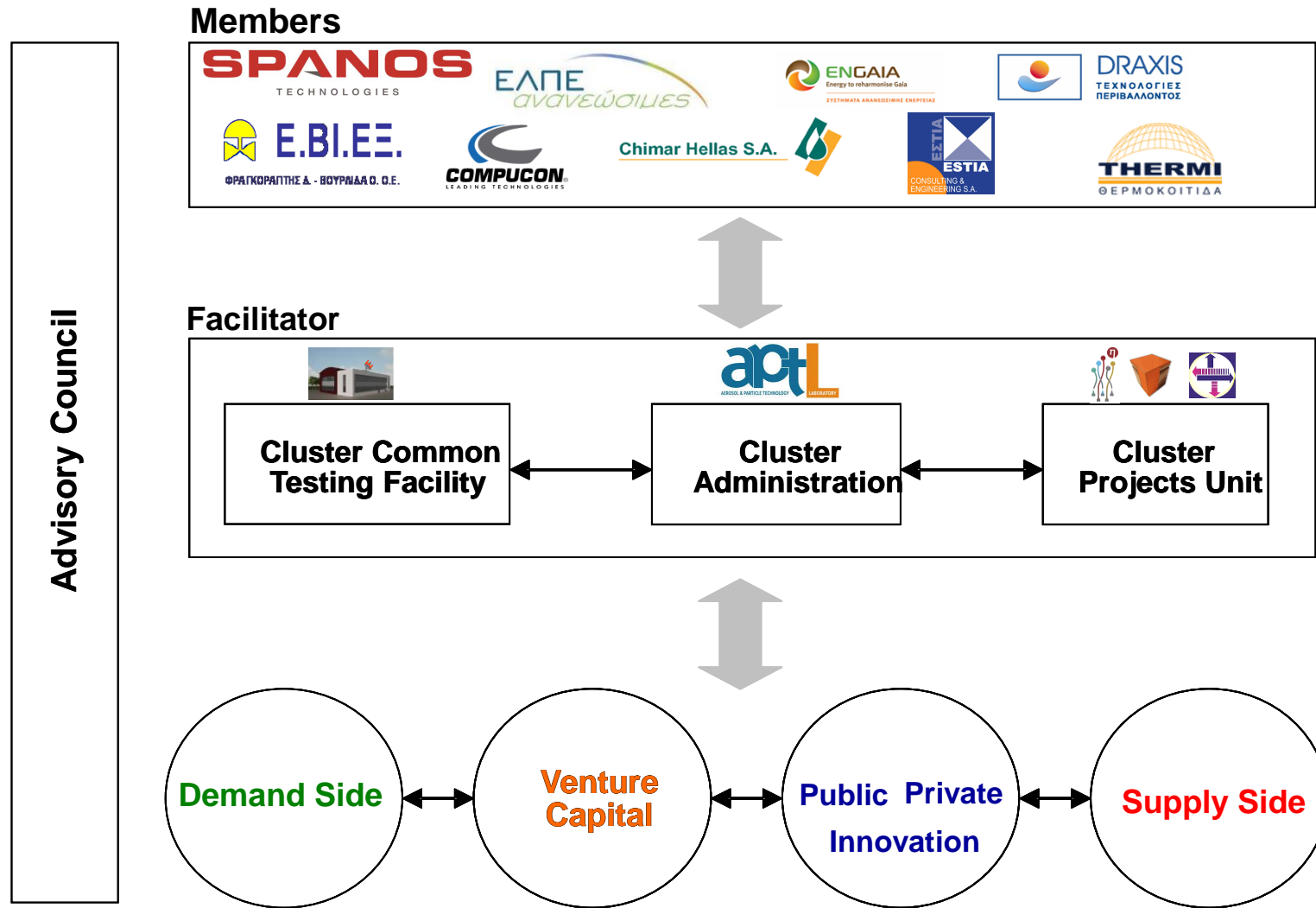


- Re-use of CO<sub>2</sub> into products (ESTIA)
- Aeolian Energy Forecasting Software (ESTIA)
- Biopolymers Production Technology (CHIMAR)
- Energy Efficiency in Buildings (DRAXIS)



- Development and International Commercialization (CERTH, THERMI)

# CHORUS Structure



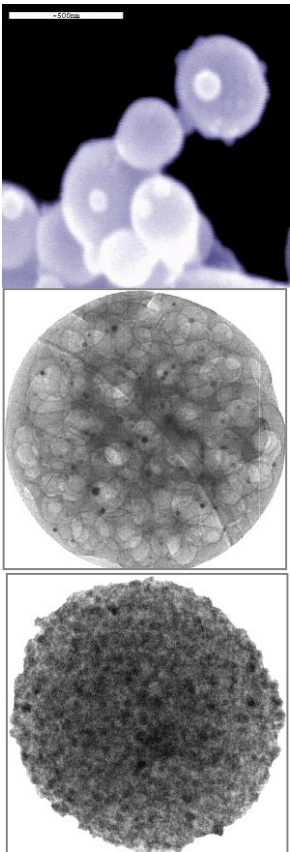
# Benefits to CHORUS Members

- Unique opportunities for **cooperation, creativity and innovation**
- Sourcing of **new knowledge** and pursue innovation opportunities through stronger links with companies, research organization, service providers and other innovation stakeholders
- Advantage of **economies of scale and shared resources**.  
A Cluster Common Testing Facility (CCTF) is designed to provide **advanced prototyping and testing services** in the cluster's thematic area

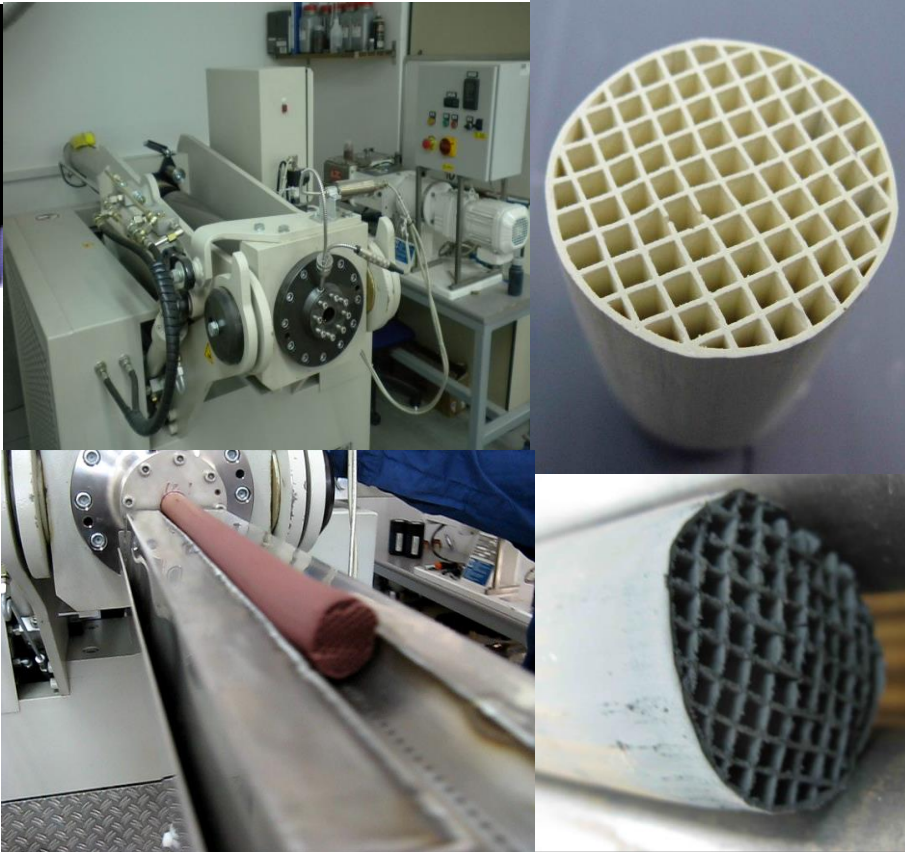
# CHORUS Common Testing Facility

## Examples of Facilities

### Materials Synthesis



### Ceramics Processing



### Coating/Functionalization





# CHORUS Common Testing Facility

## Examples of Facilities

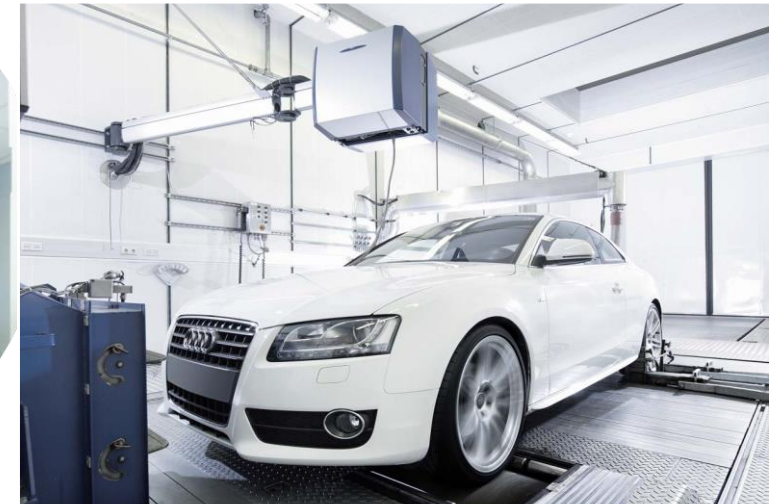
Specialized Laboratories  
Pilot Plants



Solar Simulator  
Vehicle Simulator



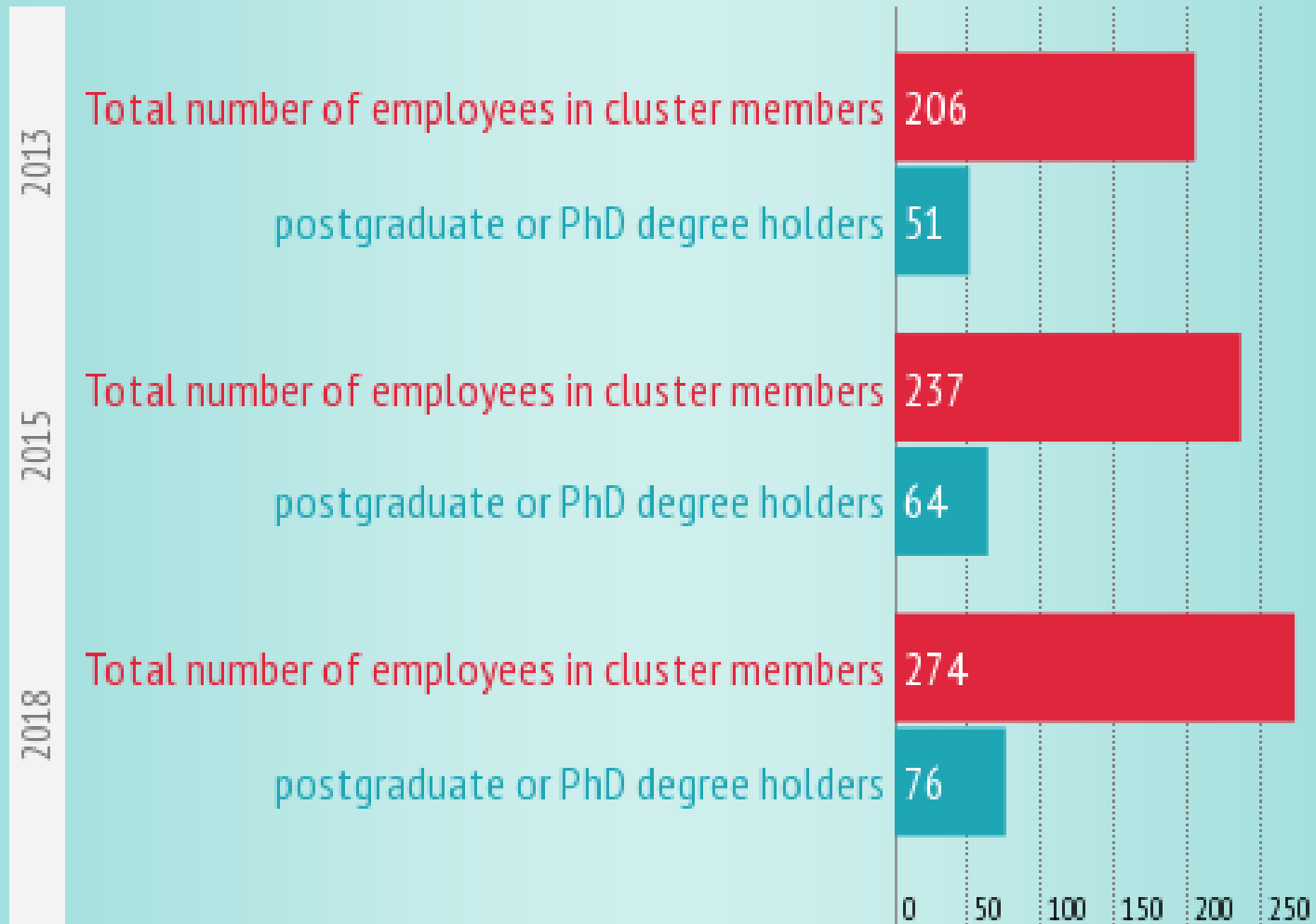
Engine and Vehicle Testing  
Field Testing



# CHORUS Impact

- Exploitation of **synergies** (leveraging of local resources)
- **Environmental benefits** (reduction of CO<sub>2</sub> emissions and other pollutants)
- **Energy benefits** (energy targets, energy independence)
- **Financial benefits** (reduction of imported energy and relevant technologies, increase of added value of the domestic production, increase of the countries competitiveness in the international market)
- **Social benefits** (public health protection, increase of employment)
- **Extroversion** (through knowhow and expertise acquired through the development of inland clean energy technology combined with supportive technologies for protecting the environment and promoting sustainable transportation)

# CHORUS Macro Data



# Epilogue

- At initiation time, the CHORUS Clean Energy Cluster brings together 10 enterprises and 3 research laboratories located primarily in the Region of Central Macedonia in Greece. It builds on the **work ethic** of the region's workforce, a **pool of knowledge** and labour that has been known traditionally throughout Greece for **excellence and innovation in the Clean Energy/Green Mobility area**.
- CHORUS encompasses the **advantages of the Region's geography**, its access routes (the Egnatia highway, the Port of Thessaloniki, the Makedonia Airport and the Railway connections) **the natural resources** (sun, fossil fuels) and **existing industrial specializations** (refineries, steel industry, ceramics, construction, waste processing, information and automation, etc) that can provide diverse opportunities in the cluster's thematic area.
- The path to this new growth paradigm for the region is based on **leadership in the energy and environmental sectors**.



# CHORUS

Clean Energy cluster