

aFuel[®]

Worlds First Carbon Negative Energy Carrier

November 10th, 2021 // Thorsten Rixmann, Chris Meusburger

Wie ehrlich sind wir in Klimafragen?







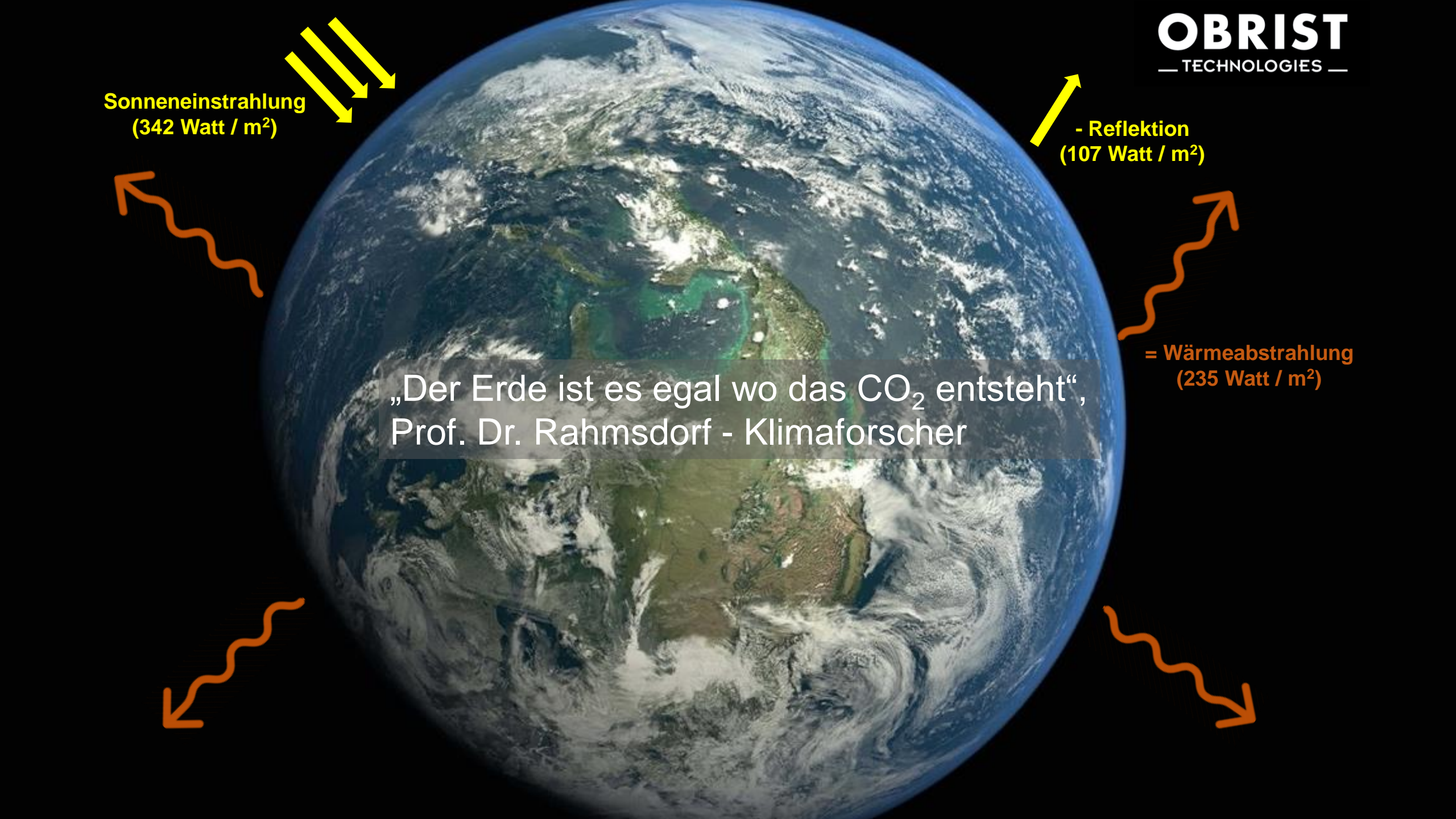


Sonneneinstrahlung
(342 Watt / m²)

- Reflektion
(107 Watt / m²)

= Wärmeabstrahlung
(235 Watt / m²)

„Der Erde ist es egal wo das CO₂ entsteht“,
Prof. Dr. Rahmsdorf - Klimaforscher

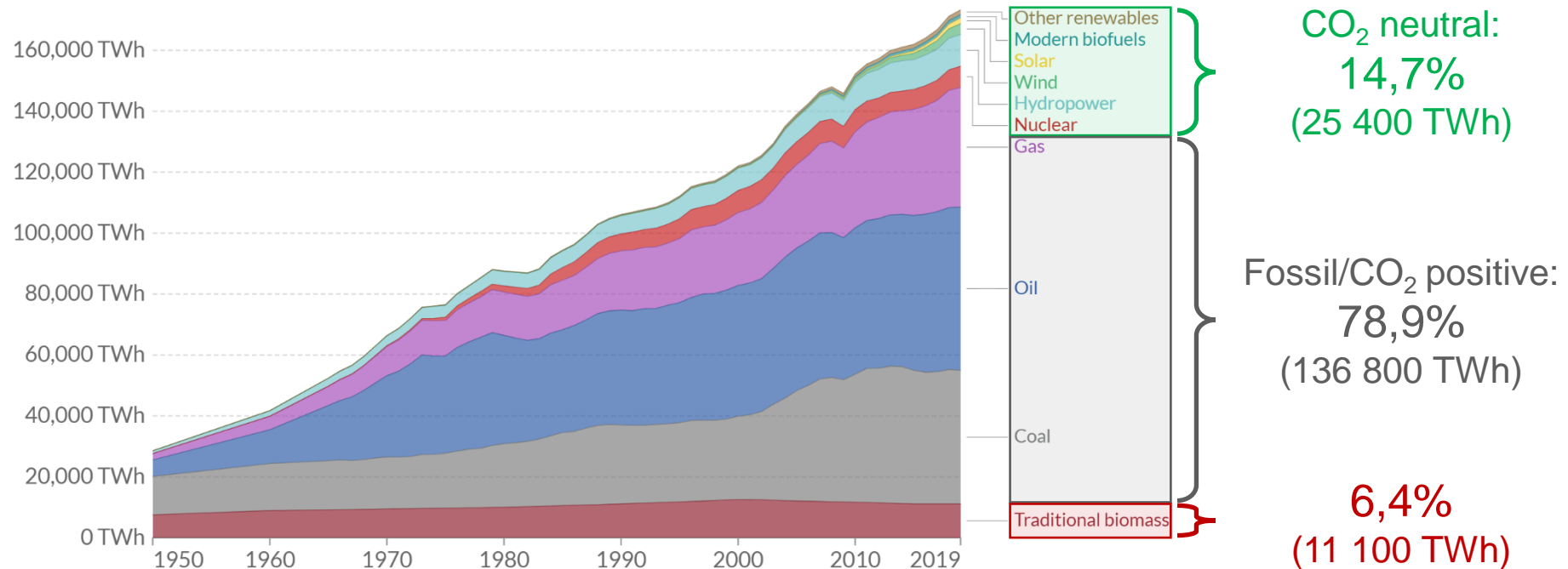


Fossil & Renewable Energy Status Quo

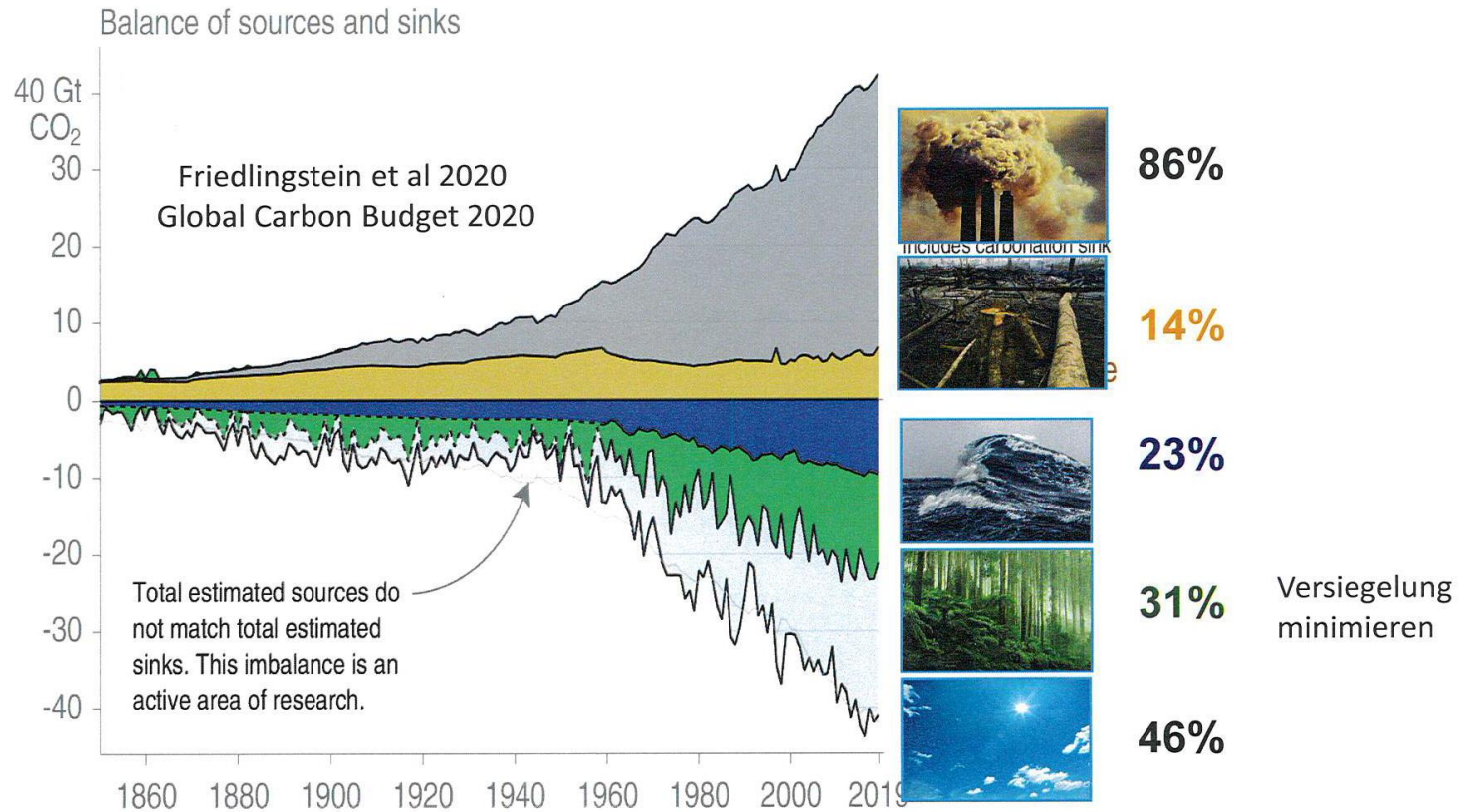
Global primary energy consumption by source

Primary energy is calculated based on the 'substitution method' which takes account of the inefficiencies in fossil fuel production by converting non-fossil energy into the energy inputs required if they had the same conversion losses as fossil fuels.

Our World
in Data



Globale Quellen und Senken



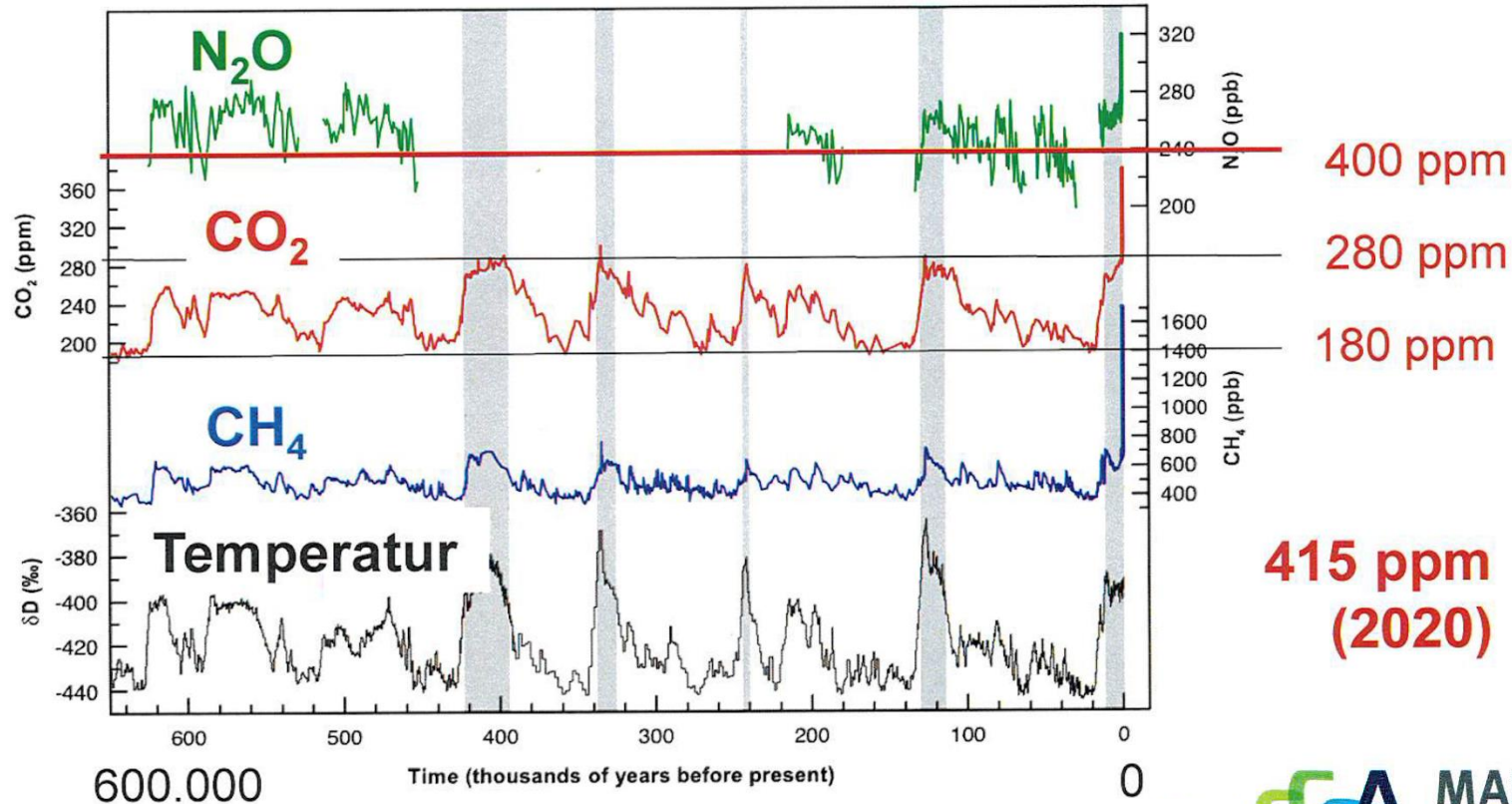
© Global Carbon Project • Data: GCP/CDIAC/NOAA-ESRL/UNFCCC

Helga Kromp-Kolb | Zentrum für Globalen Wandel und Nachhaltigkeit BOKU



THG Konzentrationen (Eisbohrkerndaten)

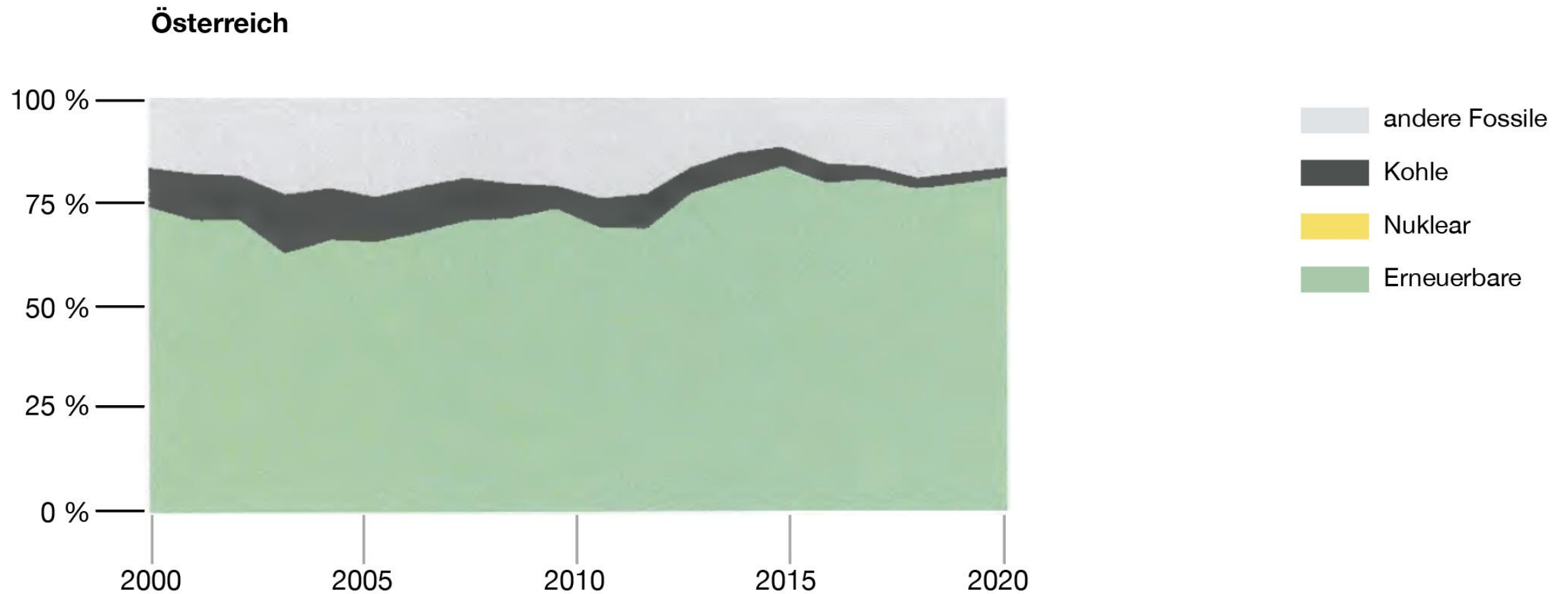
Glacial-Interglacial Ice Core Data



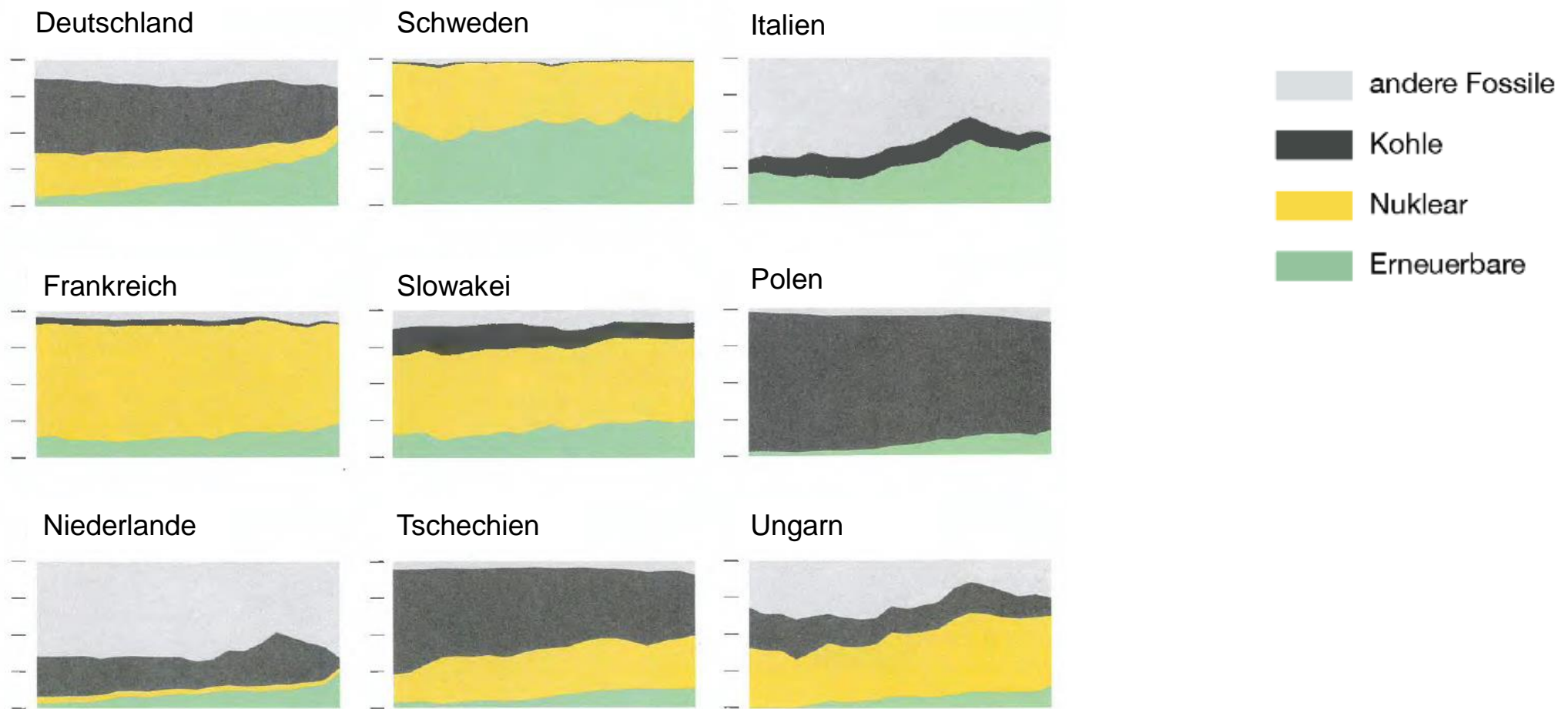
Helga Kromp-Kolb | Zentrum für Globalen Wandel und Nachhaltigkeit BOKU



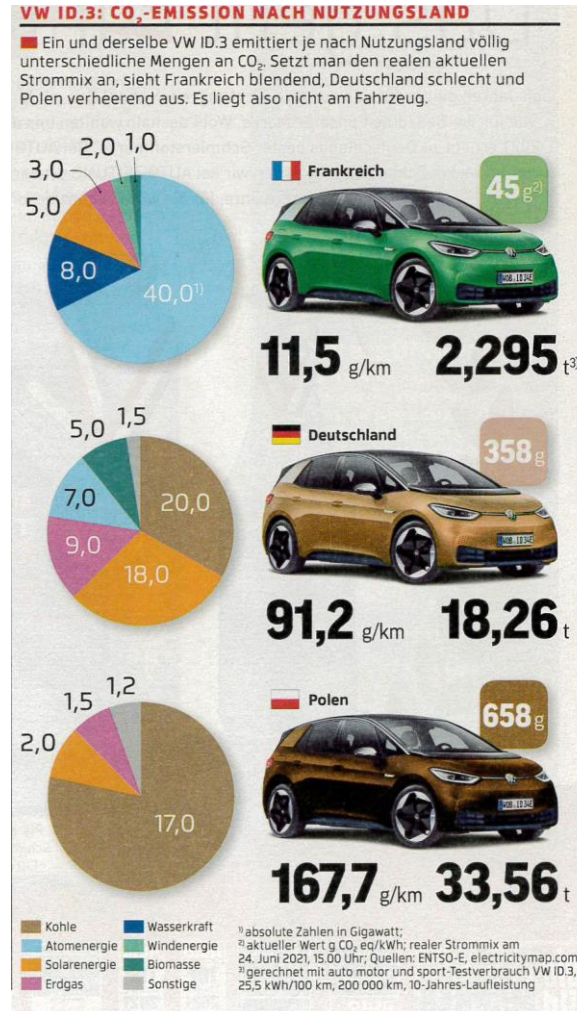
Globaler STROM-MIX (Eurostat)



Globaler STROM-MIX (Eurostat 2000-2020)



CO₂ Fussabdruck ID.3 in FR, D & PL



Wie ehrlich sind wir in Klimafragen ?

- Andeas Tschiesner (SVP bei McKinsey): “ Am Elektroauto führt kein Weg vorbei” –**Immer nur die Sicht auf Europa...**
- Diess: “Schnelle CO2 Reduzierung heist Elektrifizierung. Mit der Diskussion um Alternativen verwirren wir die Verbraucher?”
- **Was tun mit den 300 Millionen PKW in EU, der > Miliarde in der Welt?**
- “Fit for 55” – EU Kommission forciert ausschliesslich E-Mobilität, ab 2035 keine Benziner und Diesel mehr... **und der Rest der Welt?**

- Prof. Schlögl: “zero emission wird nicht mehr reichen... wir müssen pro aktiv CO2 der Atmosphäre entziehen! Wir haben die Pflicht hier zu viel mehr zu forschen”

Was sagt die Autoindustrie?

- Alleine die Ankündigungen der Automobilhersteller führen zu einer Verunsicherung der Konsumenten!
 - Mercedes Benz: “...will bis 2030 vollelektrisch werden – wo es die Marktbedingungen zulassen” ...
 - Audi: “... beendet ab 2033 die Produktion der letzten Verbrenner – mit Ausnahme von China”
 - Nissan: “... ab 2030 ausschliesslich E-Autos in den Schlüsselmärkten” und im rest der Welt?
 - Jaguar und Land Rover: “... planen eine “Zero Emission”- Modellpalette ab 2036” - unter falschen Annahmen (0g CO2 / km)

Ohne Worte ...



Globales Denken – geht nur mutig & ehrlich (Zusammenfassung)

- Die Reduktion der Emissionen (CO₂,...) muss GLOBAL erfolgen
- Aktuell werden nach wie vor Kohlekraftwerke, Atomkraftwerke und andere Kraftwerke fossilen Ursprungs gebaut
- Europa ist ein Energie-Import-Kontinent
- Die massive Zufuhr von erneuerbaren Energien erhöht die Blackout Gefahr und erhöht die Energie-Preise massiv
- ...wir müssen den günstigsten grünen Strom der Sonne nutzen, verflüssigen und in den bestehenden Transportsystemen verteilen



Offering Green Technology for the World

Green Refrigerant

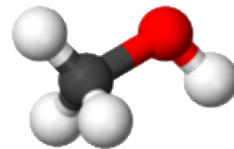
R744 / R290comp. / eScroll



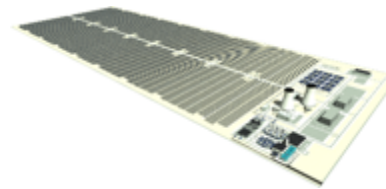
HyperHybrid The Smarter Electric Vehicle



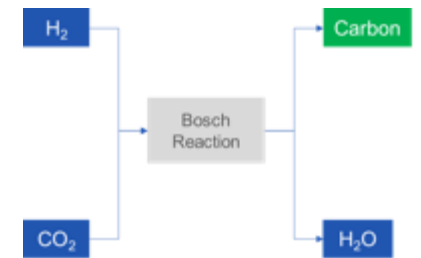
Global Energy Carrier aFuel®



“The Modern Forest”



Active CO₂ Reduction



Global Relevance Today





aFuel[®] -24g CO₂ / km Emissions
revolutionizing energy of tomorrow

Prototype Vehicle



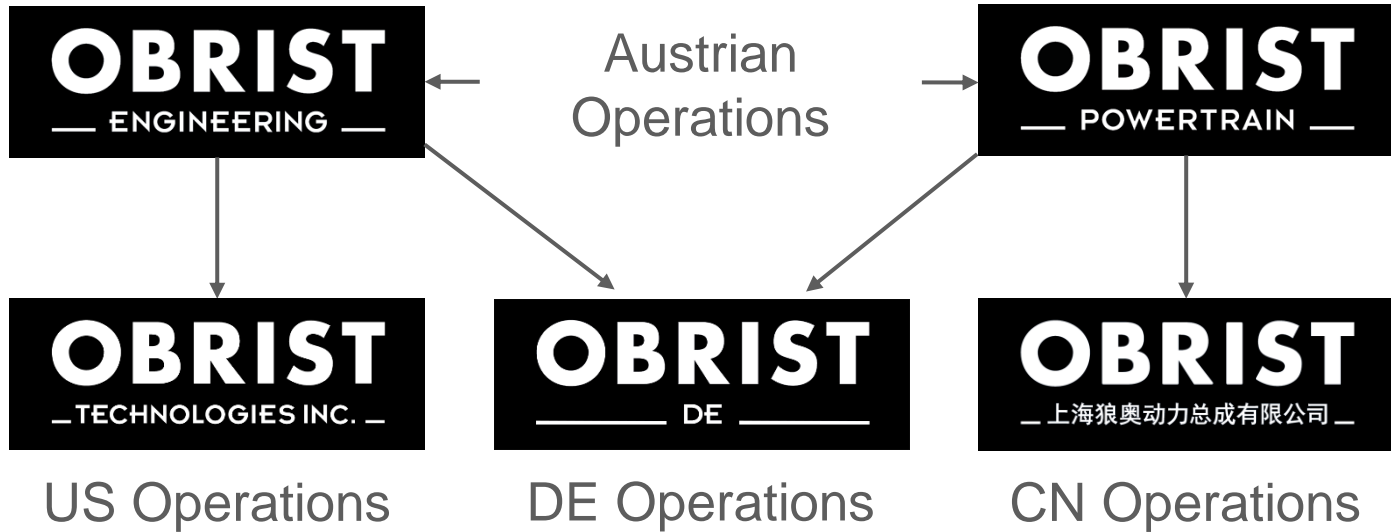
„Join our path to sustainable,
emission reducing innovations!“
Frank Obrist



Engineering for Emission Reduction

Thermal Management

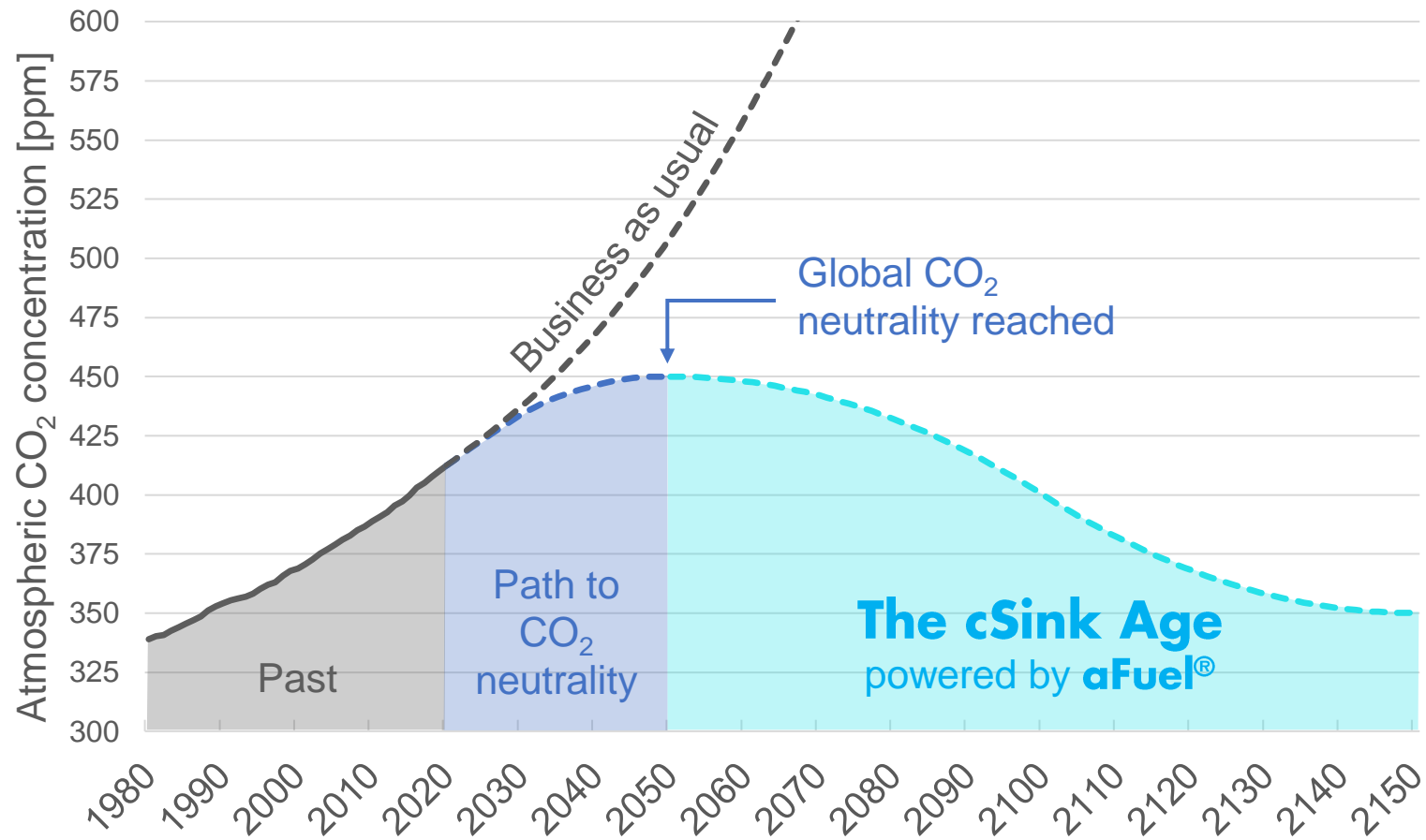
Hybrid Powertrain



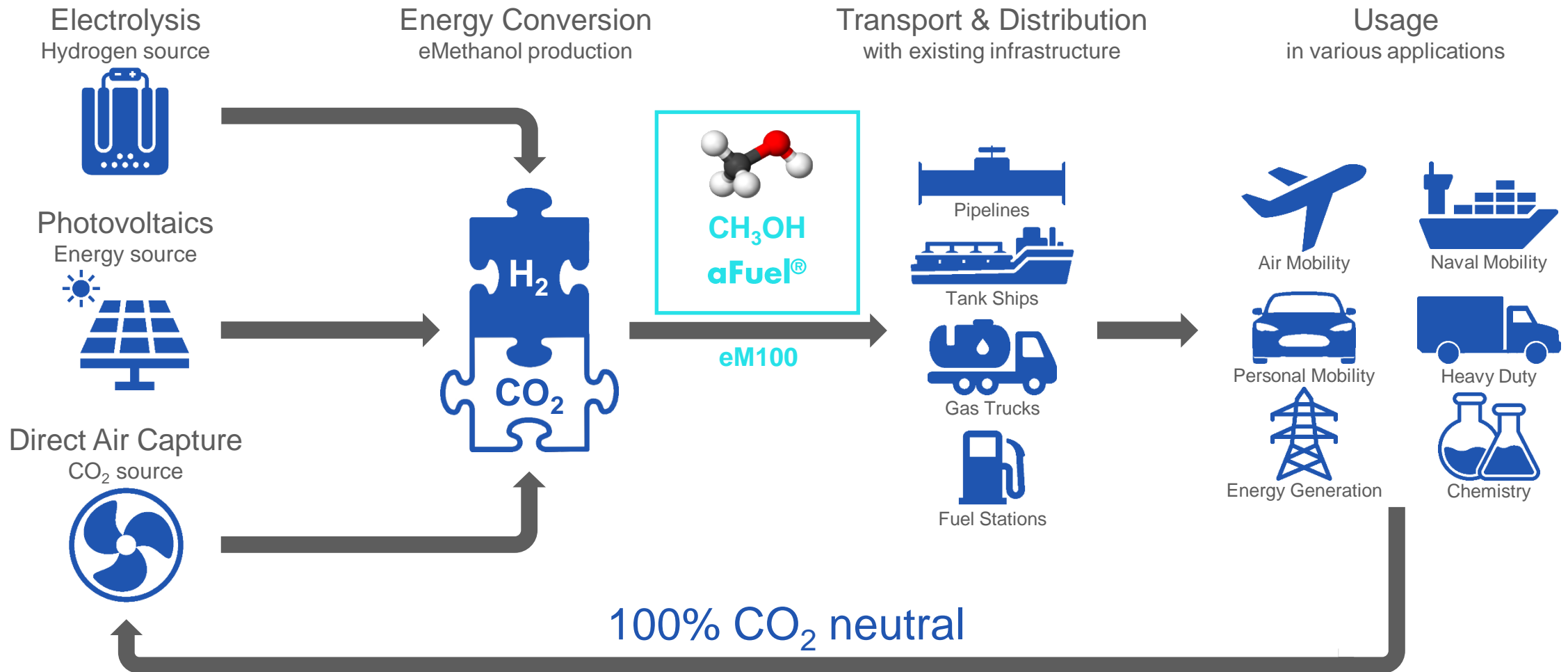
Based in the newly acquired Felix Wankel Institute



Atmospheric CO₂ Reduction The Path to Global CO₂ Negativity

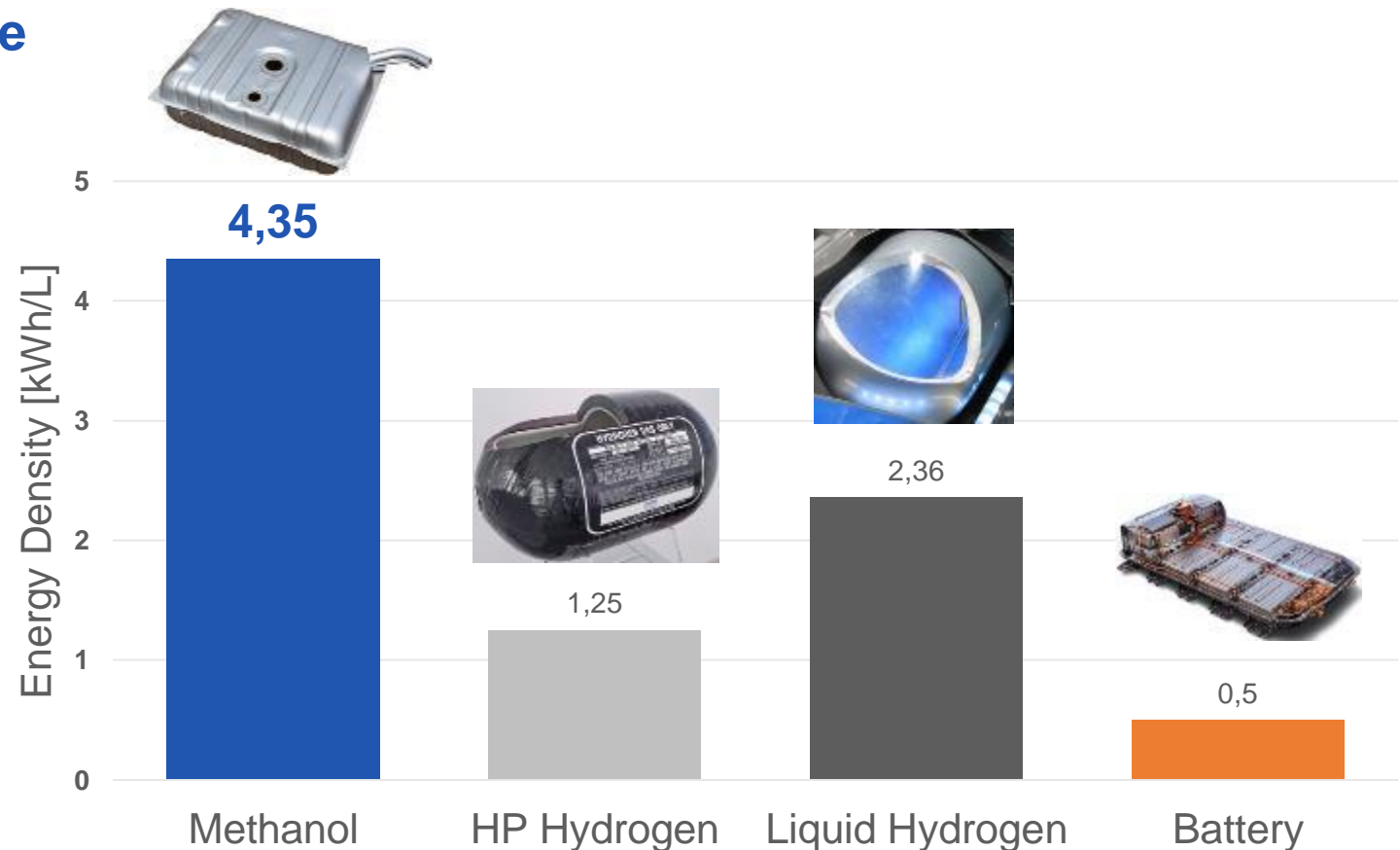


aFuel® Revolutionizing Energy of Tomorrow

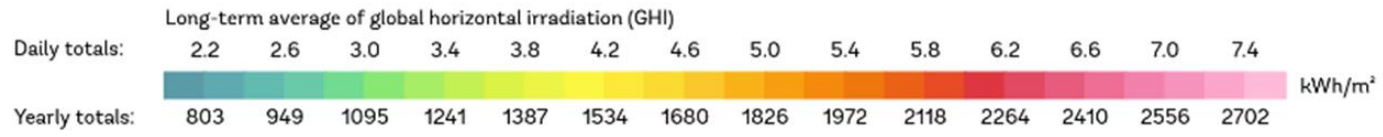
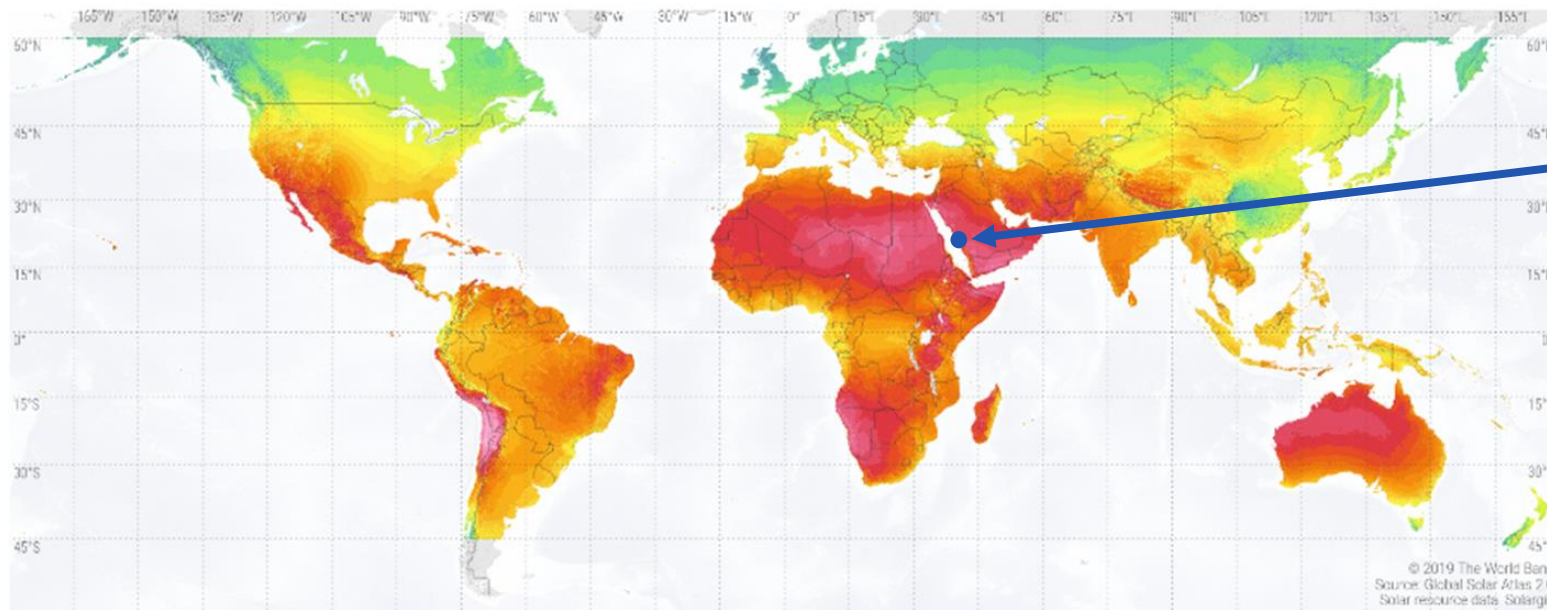


Comparison Energy Density Energy stored per Liter (without Tank)

- Methanol is **more energy-dense** than hydrogen or batteries
- Unlike hydrogen, methanol **does not need pressurized or heavily cooled tanks** to be stored or transported
- Methanol carries more hydrogen than hydrogen itself → **best hydrogen carrier**
- Safety of liquid energy carriers higher compared to gases



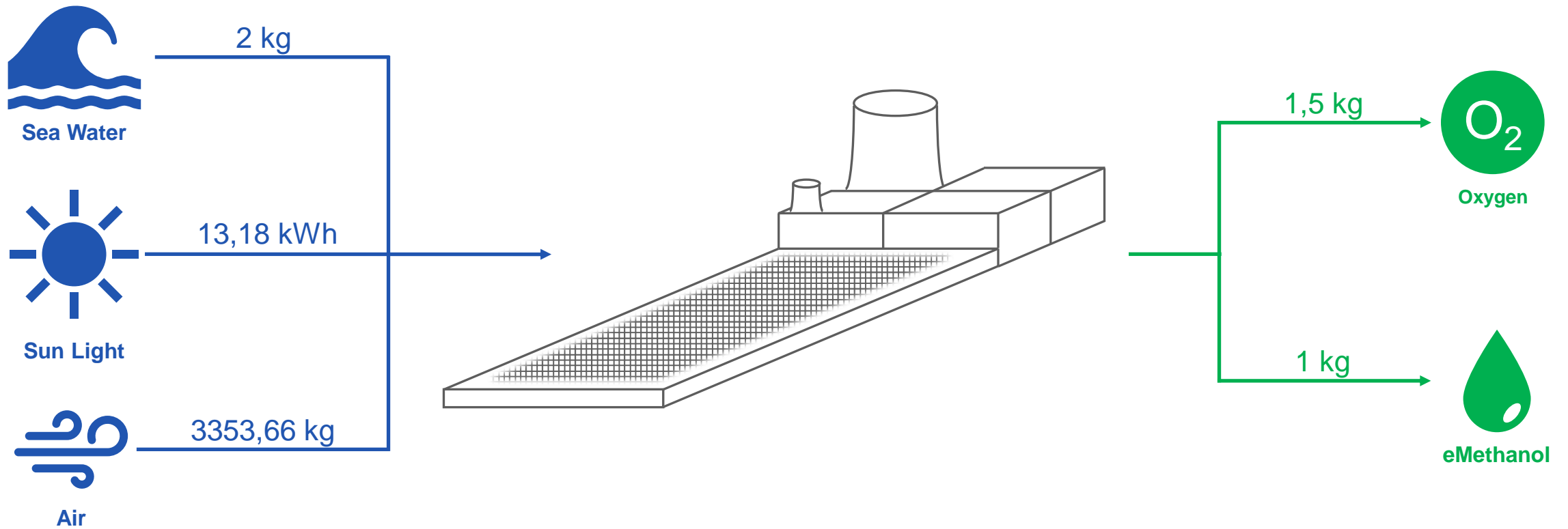
Photovoltaics in Sun Belt Cheapest Energy worldwide



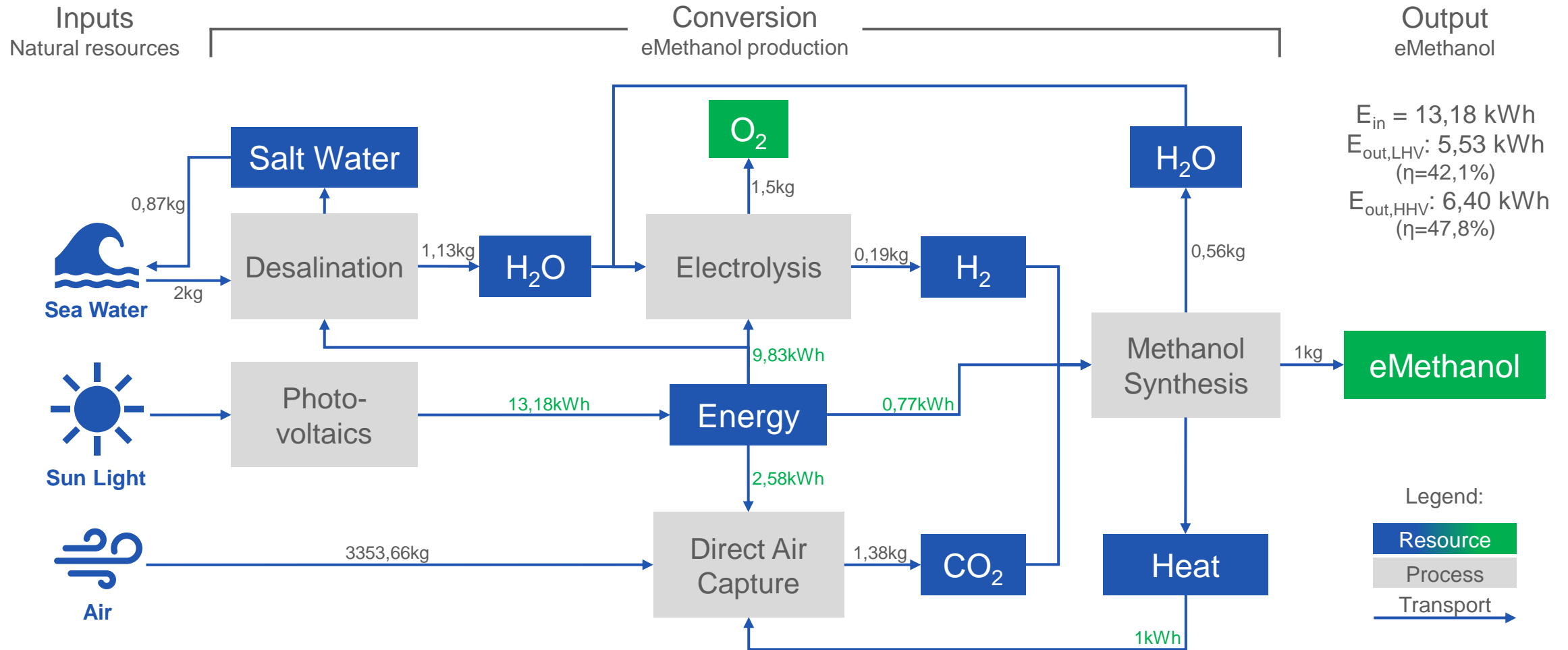
Shuaibah, Saudi Arabia
600MWp
2400kWh/m² irradiance

0,88 ct/kWh
Lowest LCOE worldwide
(April 2021)

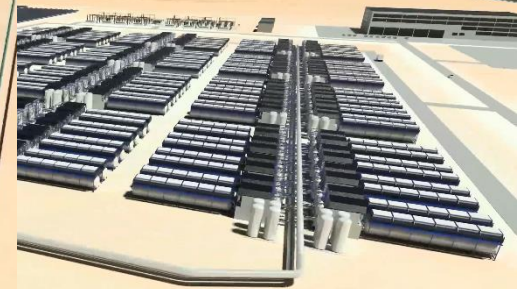
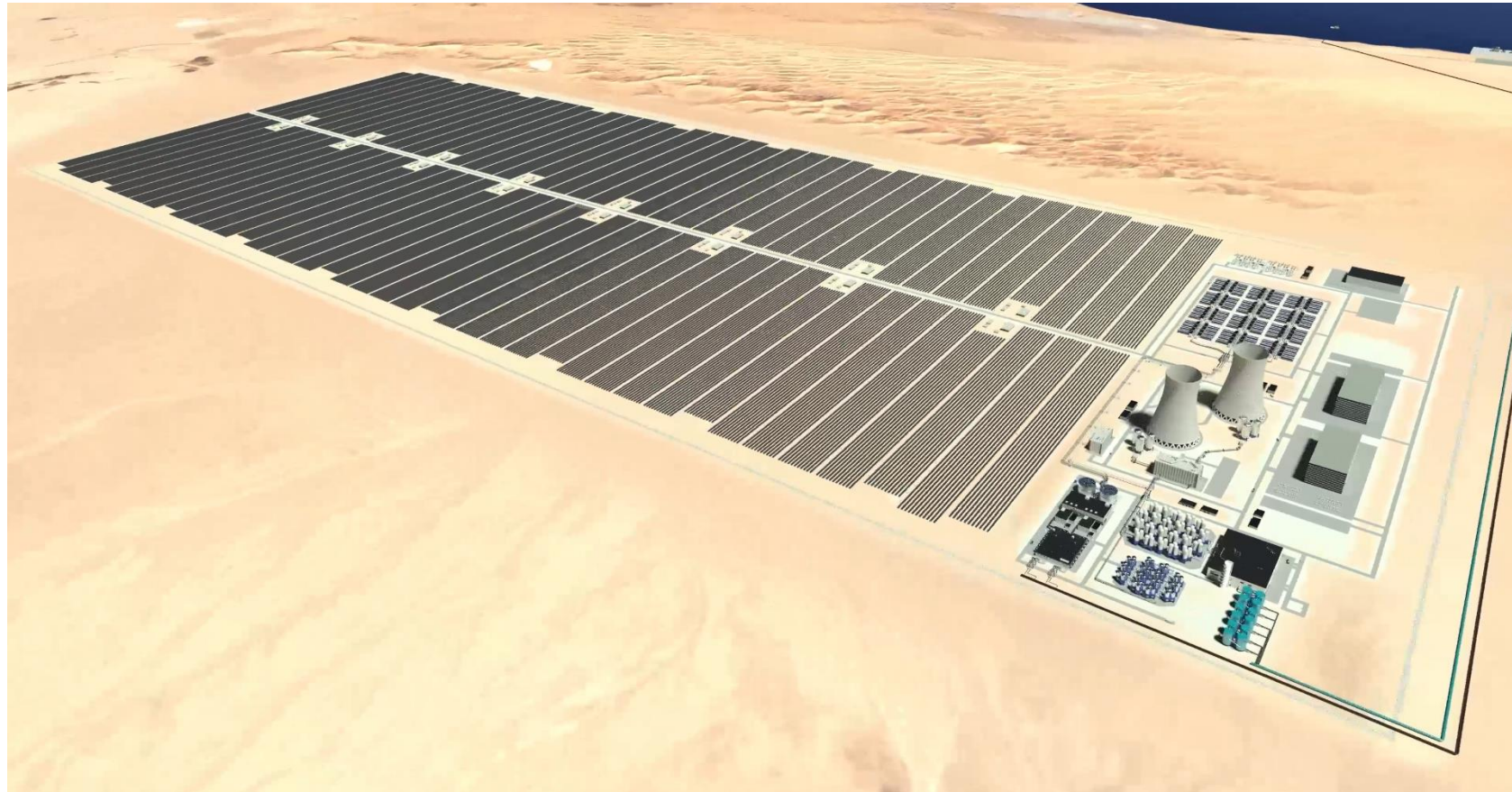
The Modern Forest Basic Concept



eMethanol Synthesis H_2 from Electrolysis, CO_2 from Atmosphere



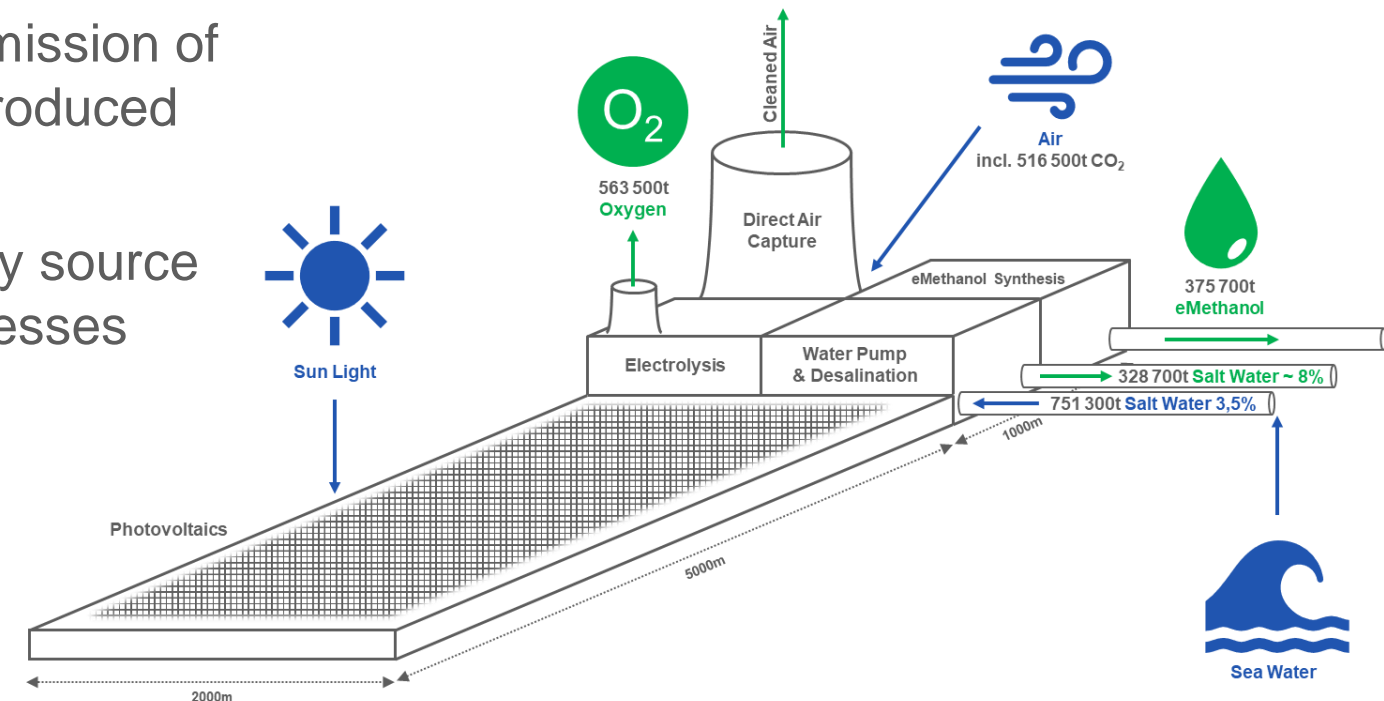
aFuel[®] Plant Concept



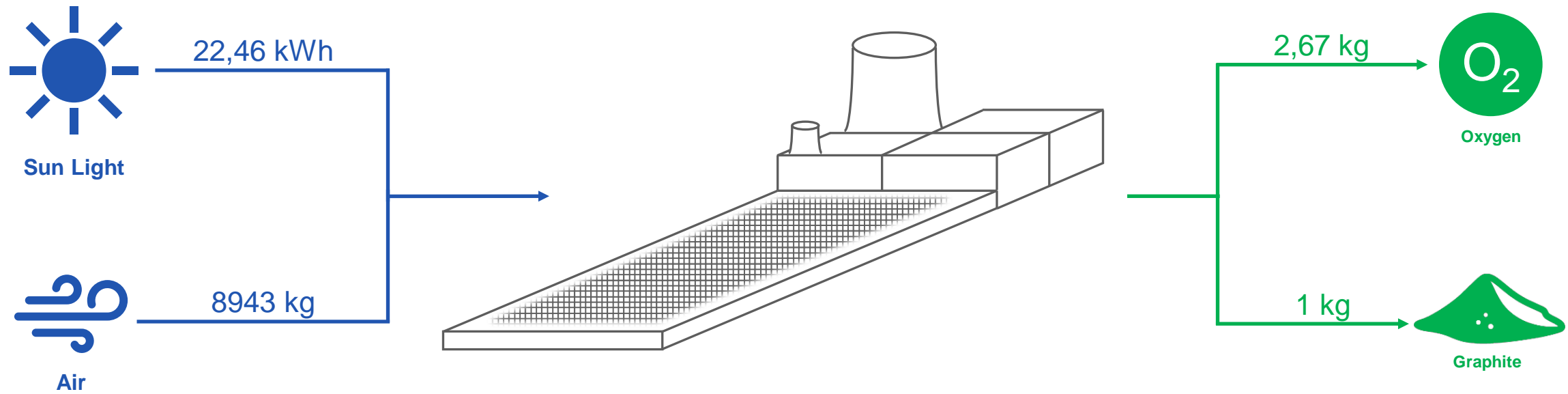
The Modern Forest

Basic Concept for a eMethanol Production Plant

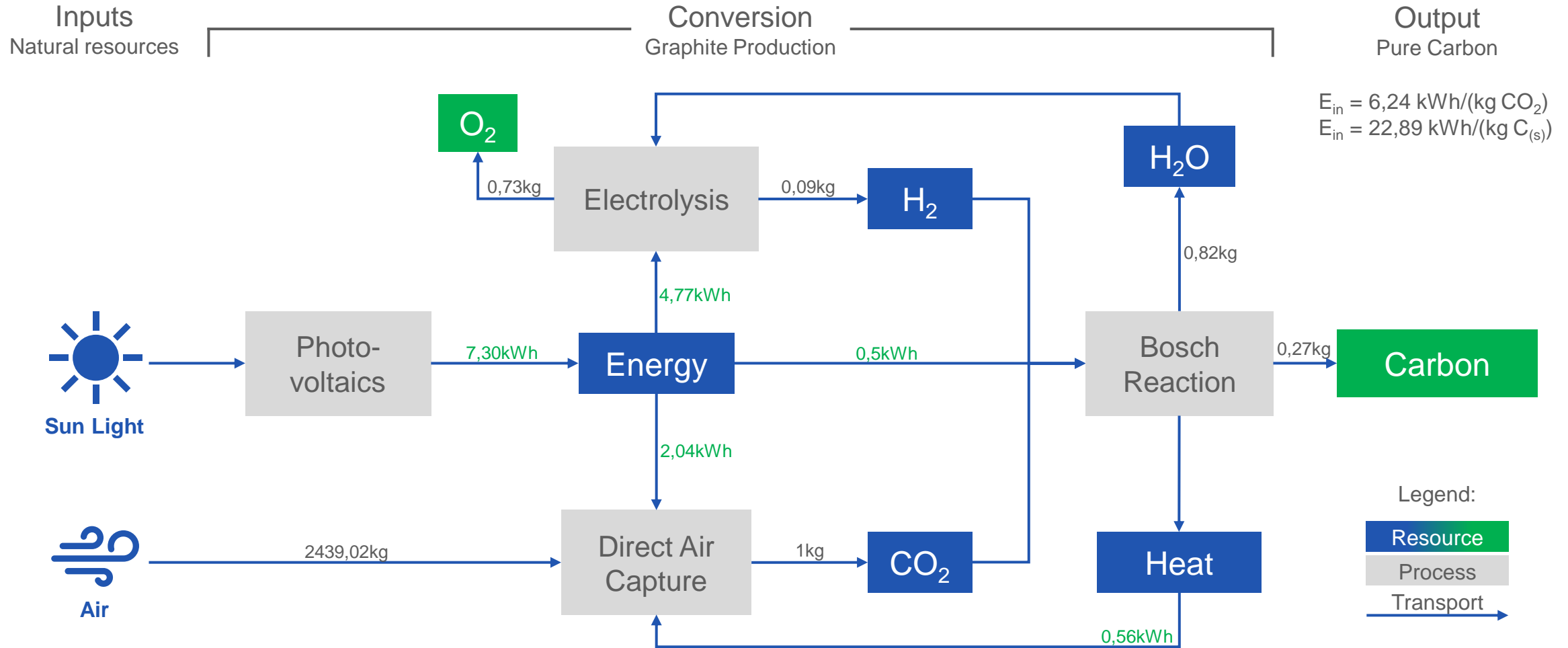
- eMethanol is renewably produced from solar power, hydrogen from water electrolysis and CO₂ directly from the atmosphere
- Consumption of 1,38kg CO₂ and emission of 1,5kg oxygen per 1kg eMethanol produced
→ „**Modern Forest**“
- Combination of the cheapest energy source worldwide, state-of-the-art subprocesses and a sensible end product



The cSink Basic Concept



The cSink Concept of a CO₂-negative Technology



Bosch Reaction Concept of a CO₂-negative Technology

- Captured CO₂ can be **transformed into pure carbon** (graphite) through the Bosch reaction:
- $\text{CO}_2 + 2\text{H}_2 \rightarrow \text{C} + 2\text{H}_2\text{O}$, $\Delta H^0 = -178,3\text{kJ/mol}$
Catalysts: Iron, Cobalt, Nickel, Ruthenium
Process temperature: 530 – 730°C
- Resulting graphite is stable and non-reactive
→ can be used to **safely store carbon** (e.g. in the sea)
- Simple, effective carbon sink for **past, already existing emissions**



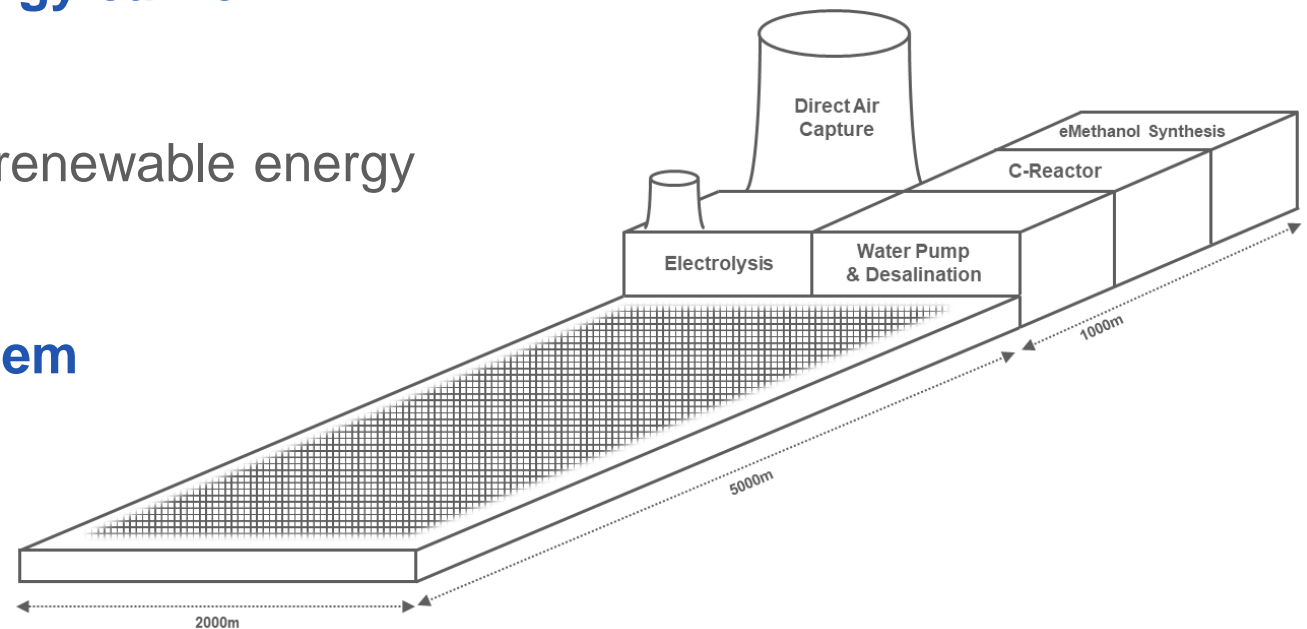
Combination of eMethanol and cSink: **aFuel**®

- eMethanol and the cSink technologies can be **combined into one plant** that produces **aFuel**® (e.g. 90% eMethanol/10% cSink)

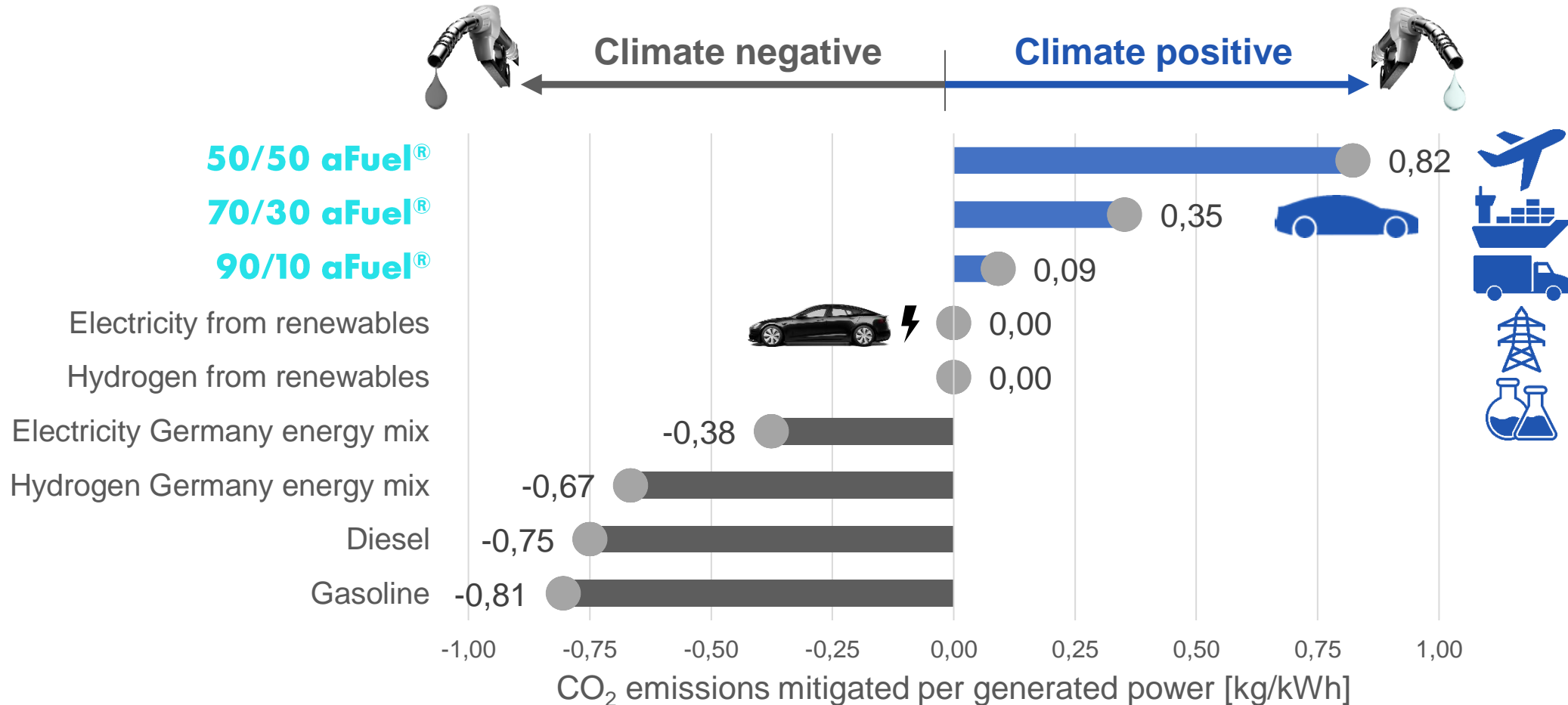
→ **World's first climate-positive energy carrier**

- Most effective way to transport cheap renewable energy around the whole planet

→ **Global solution for a global problem**



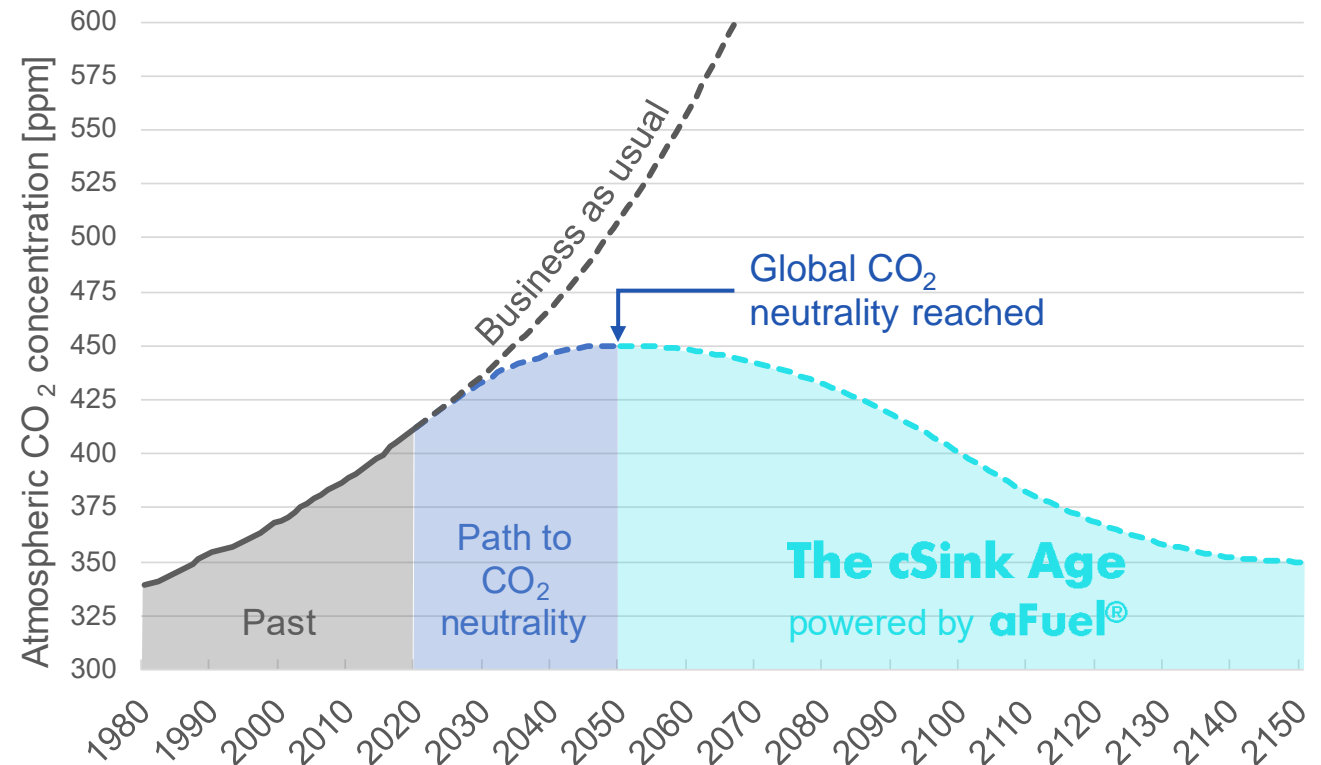
aFuel® World's First Global Climate Positive Fuel



Atmospheric CO₂ Reduction The Path to Global CO₂ Negativity

- After reaching CO₂ neutrality, it is **mandatory to reduce CO₂ levels** in the atmosphere to reverse all damage that humanity has caused over the past centuries
- CO₂ negative technologies **have to be carbon-based**
- **aFuel®** enables not only CO₂ neutrality, but even **CO₂ negative energy generation**

We believe that we have the solution for **becoming CO₂ neutral** as well as **being CO₂ negative**.



aFuel® Vehicle Presentation IAA Mobility Munich 2021



Dr. Gerd Müller
Future president of UNIDO



Our Solution for Humankind's Biggest Problem

- Reaching our primary goal: **stopping and reversing climate change**
- Using existing, collaborative technology, we can create an energy source that is **affordable, sustainable and transportable**, all on a global scale
- Generation of, and access to **aFuel®** will **boost global economies** and **create collaborations** between the world's most innovative technologies and minds

Unite with us to create world free from fossil fuels.

The solution already exists.

Act now!



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