

SOLWIN – Renewable Energy

SOLWIN Renewable Energy

1. Hydrogen

Refuels

2. Advanced Biofuels

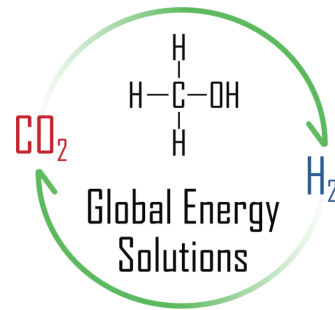
3. E-Fuels



SOLWIN Network



Dii



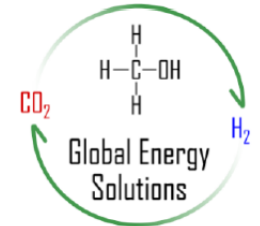
BOSCH

NESTE



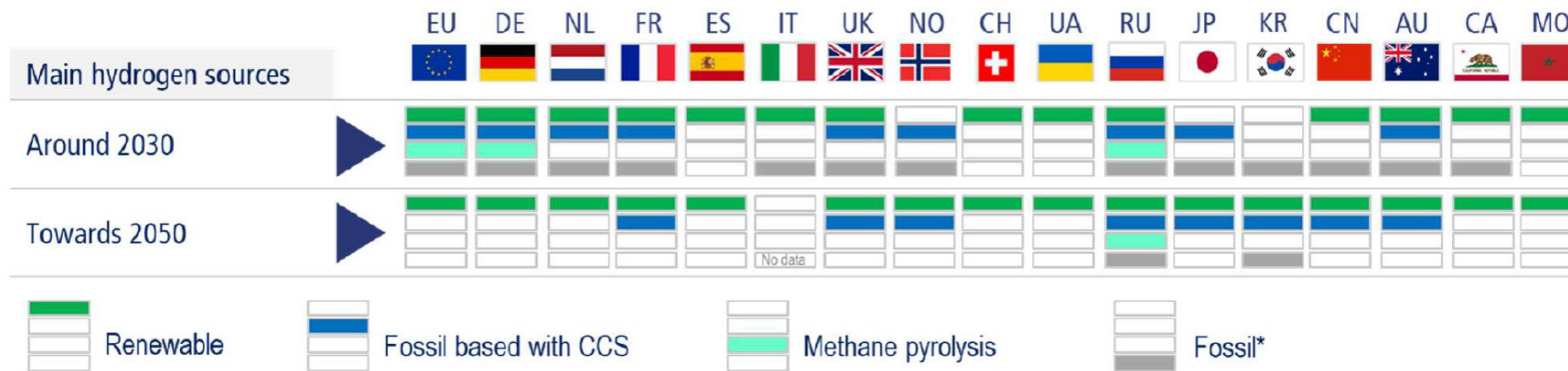
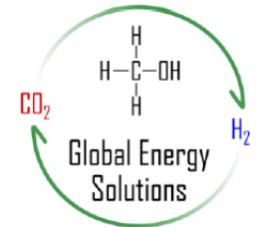
SOLWIN Hydrogen – Global Energy Solutions

Warum Wasserstoff?



- **Direkteinsatz**
 - Chemierohstoff (Grundstoff)
 - Brennstoffzelle (Mobilität, Wärme) } $H_2 + O_2 \Rightarrow H_2O$
- **Decarbonisierung**
„energieintensiver, klimaschädlicher Industrieprozesse“
(sonst nicht zugängliche Industrieprozesse)
 - Beispiel: Reduktion von Eisenerz mit H₂ statt CO
- **Speichermedium** für grünen Strom
ebenso seine Derivate (PtX „Power to X“):
 - Methanol CH₃ OH
 - Methan CH₄
 - Ammoniak NH₃
 - LOHC Liquid Organic Hydrogen Carrier } Etablierte Regeln und bestehende Infrastruktur!
- **Sektorenkopplung**
Vernetzung von Energieerzeugung und Energienutzung diverser Industrien
um variable Energieflüsse aus erneuerbaren Energien auszugleichen

Wasserstoffstrategien sind verstärkt im Fokus

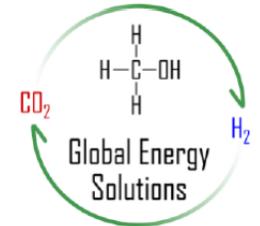


* In Russia in 2050 mainly based on nuclear power

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- 20 Länder (~44% des Welt-BSP) haben eine Strategie verabschiedet oder in Arbeit, weitere 31 Länder (nochmals ~44% des Welt-BSP) verfolgen zumindest einzelne Projekte
- Bis 2025 sollten Staaten die 80% des Welt-BSP repräsentieren über Wasserstoffstrategien verfügen
- Das Potential wird auf bis zu 9.000 TWh (~ 270 Mio. t) bis 2050 geschätzt

Und was heißt das praktisch?



- 7 Mrd. € Förderung in D als Teil des Corona-Konjunkturpaketes und weitere 2 Mrd. für internationale Projekte
- Schaffung eines Nationalen Wasserstoffrates mit 25 Experten
- Bedarf bis 2030: ca. 90-110 TWh H_2 (~3,5 % vom Primärenergieverbrauch),
 - dafür bis zu 5 GW grüne Elektrolyse incl. Offshore- und Onshore Energiegewinnung (ergibt 14 TWh H_2 und dafür 20 TWh Strom)
 - bis spätestens 2040 weitere 5 GW, d.h. ca. 25 % würden national durch H_2 gedeckt
- 20 Reallabor-Projekte, tlw. durch IPCEI auch europäisch gefördert
- **H_2 Global** „Die globale Energiewende gestalten“
 - Konzeptvorschlag zur auktionenbasierten Förderung eines zeitnahen und effektiven Markthochlaufs von grünem Wasserstoff (H_2) und PtX-Produkten
 - temporärer Ausgleich der Differenz zwischen Ankaufspreis (Erzeugungs- plus Transportkosten) und Verkaufspreis (entspricht derzeit Marktpreis für fossilen Wasserstoff) für grünen H_2 und H_2 -Derivate
 - Doppelauktionsmodell. Der niedrigste Angebotspreis und der höchste Verkaufspreis erhalten jeweils den Zuschlag, so dass die auszugleichende Preisdifferenz so gering wie möglich ausfällt
- Wasserstoff als Alternative zu Kraftstoff (**RED II**)
 - 28 Prozent erneuerbare Energien im Verkehrssektor bis 2030 (EU 14 %)
 - Strombasierte Kraftstoffe auf Basis von H_2 nur schrittweise auf 2% => stattdessen in Industrie und Luftverkehr
 - Direkter Stromeinsatz in Elektroautos wird mit dreifacher Anrechnung gefördert

SOLWIN Hydrogen

Key Figures

- Market potential > 2.3 Trillion €
- 30 countries with roadmap
- Investment volume until 2030: 300 Bio. €
- Worldwide > 220 major projects

Key activities/talks (as of today)

- Bavaria, Baden Wurttemberg
- Switzerland & France (Auto region Saarlux)
- USA/ Texas (Governor office)

Cooperations

- Aramco Research Center Paris
- Dii Desert Energy (Munich, Dubai)
- Global Energy Solutions
- Messe Frankfurt (Mobility & Logisctics)
- TUM Heilbronn („Energy Intelligence Center“)

Exchange planned

- Federal Ministry for Economics and Climate Action (Germany)
- H2Global and other initiatives

SOLWIN – Dii Desert Energy



Dii

Just to give an impression of the wealth of the Arab Deserts:

Only a few % of the vast MENA Deserts alone would, in theory (!), be more than sufficient to power the world's 150.000 TWH Energy Consumption!

Our Mission: No Emissions!

The deserts of Northern Africa and the Middle East (MENA) are still almost fully 'fossil' based, but they are a potential supplier of lowest cost green energy for their 500 mln inhabitants and to the world energy markets.

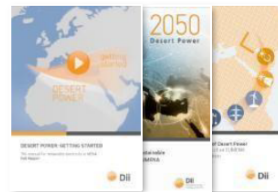
Dii Desert Energy (Desertec3.0) is an international industry initiative, founded in 2009 in Germany as an international industry **Market Enabler** for 'Green Electrons and Molecules' (e.g. Hydrogen, PtX), connecting people and countries for accelerating the energy transition in MENA and for MENA to become an exporter to the world energy markets.

12 Years Dii Desert Energy (Desertec Industrial Initiative) Energy Transition for Emission Free Energy Security

Development phases



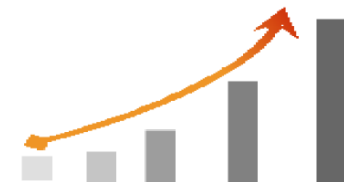
- Studies on the **Desertec vision** a.o. TREC (Trans-Mediterranean renewable energy Cooperation Studies)
- Creation of **awareness and motivation**



- **Desertec 1.0**
- **Power from the deserts for Europe**
- **Foundation of Dii GmbH (Munich) in 2009**
- **System, country and technology studies (Desert Power 2050, Desert Power: Getting Started)**
- Local adoption of idea
- **Preparation of services** for implementation phase

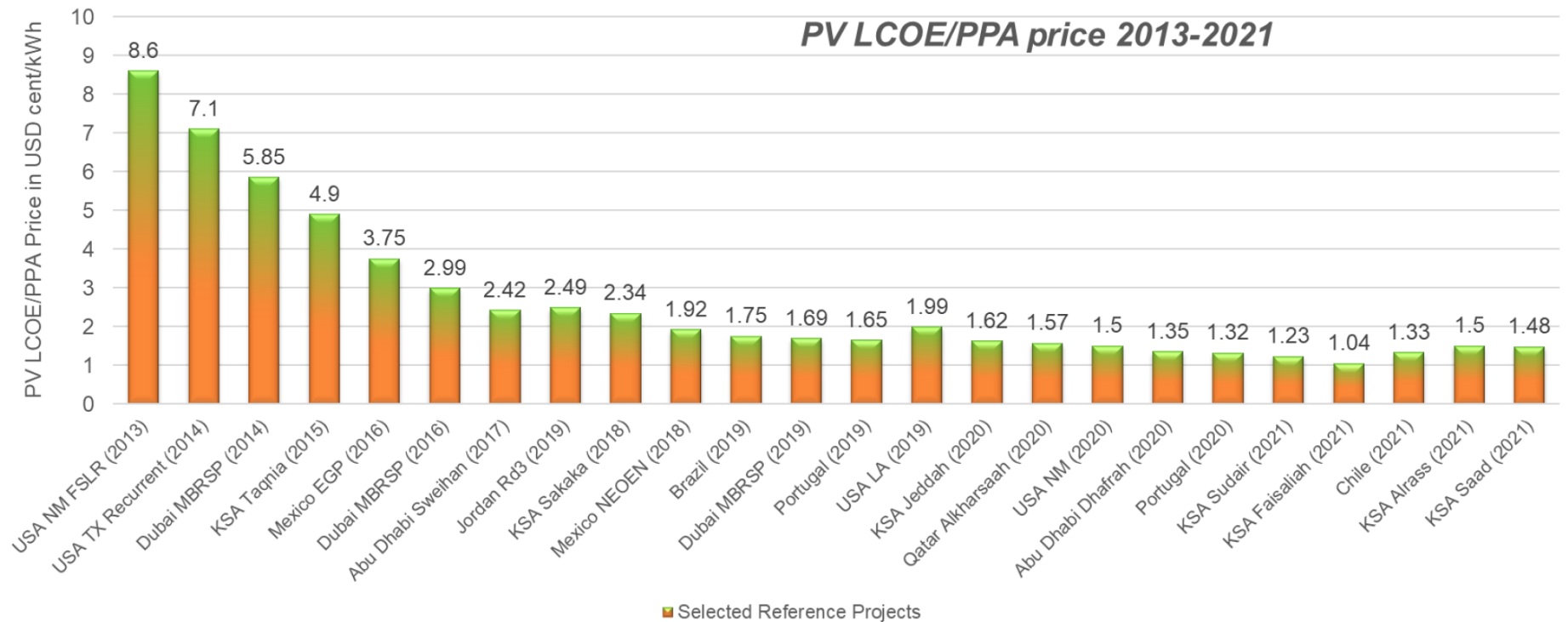


- **Desertec 2.0**
- **Development of the market in the MENA Region first**
- Dii active from Dubai, UAE
- **Identifying and solving practical hurdles** of wind/solar/grid projects
- International industry network '**Dii Desert Energy**'
- **Renewables become competitive!**



- **Desertec 3.0 Market acceleration** towards 100% **green electrons and green molecules**, transportation, storage and flexible demand in MENA
- **Full Market integration** throughout MENA and connected markets. MENA to become a 'Powerhouse for green electrons and green molecules for the world energy market'
- **Increased focus on Industry Sector Coupling** through green power, hydrogen, etc.

Solar PV, a clear game changer ! 1-2 cents solar PV, 2-3 cents wind.



NEOM (Saudi Arabia), an emerging world leader in green ammonia export (initially by vessels)

- New 'city', the size of Belgium (26,000km²)
- One of three strategic projects of Saudi Agenda 2030
- Saudi's Public Investment Fund and others have committed \$500 billion
- NEOM will be powered by 100% low-cost renewable energy (40 – 60 GW)
- Given the availability of competitive and low-cost renewable energy, NEOM will produce green hydrogen at scale for local and world markets
- NEOM, ACWA Power and Air Products signed in July 2020 an Agreement for 5 Billion\$ Solar based Green Hydrogen for producing 1.2 mln tons of Green Ammonia per year



CEPRI's Leadership: 60 industry partners from over 25 countries

OUR STRATEGIC PARTNERS



OUR LEAD PARTNERS



All Partners of Dii Desert Energy are members of the MENA Hydrogen Alliance

OUR ASSOCIATED PARTNERS



Cooperation Dii Desert Energy with Regional and International Institutions

OUR COOPERATION PARTNERS



Maintaining a network of associations, industrial initiatives, development banks & NGOs

Undertakings

- Recognition in the Arab region and Europe
- New cooperation agreements from **IRESEN** (Morocco) and **RCREEE** (Egypt)
- Dii GmbH joins the **European Clean Hydrogen Alliance**
- Participation of **Hydrogen Europe** and **CertifHy** at the Dii (hybrid) partners' meeting in February
- Continuous keynotes, panel participations, podcast and interviews



European Clean Hydrogen Alliance

Kick-starting the EU Hydrogen Industry to achieve the EU climate goals

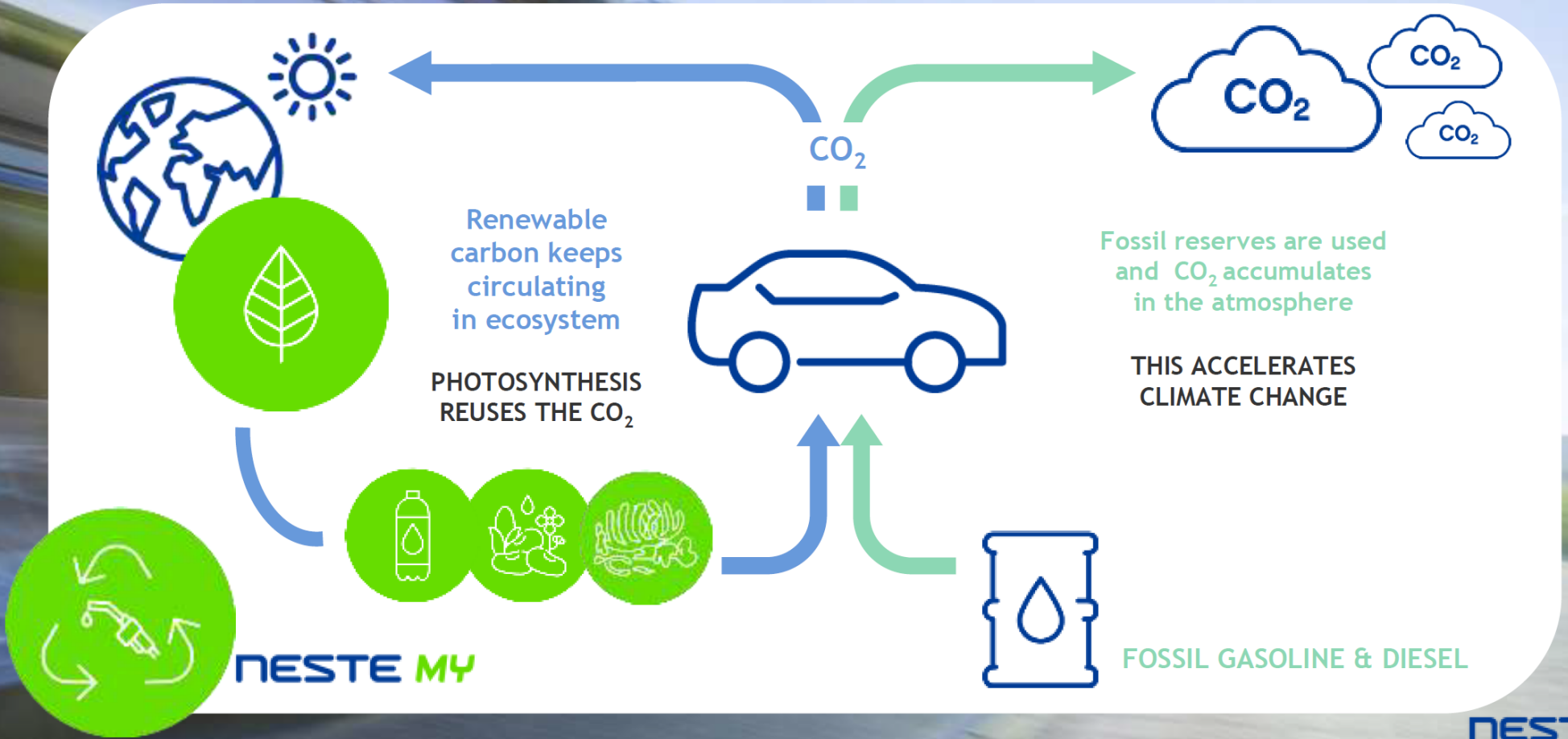


Desertec3.0: Conclusions

- MENA is a late starter in the energy transition, but it has the best cards for becoming the most important green energy Powerhouse globally. The present global climate actions and, among others, the emerging Hydrogen wave are giving highly competitive solar and wind energy from the deserts wings!
- The international industry, united in **Dii Desert Energy and its Desertec3.0 approach** is ready to assist regional governments to accelerate the energy transition along the energy value chain. In the region and in international trade of green electricity, hydrogen and other energy carrying molecules and, hence to create local industries, jobs and other benefits.

SOLWIN Refuels – NESTE

In the case of Neste renewable diesel, renewable carbon keeps circulating in the ecosystem



Neste's innovation platforms aim at commercial operations by 2030

Raw materials and technologies

End-use segments



Renewable hydrogen

Pilot project ongoing at Neste's Rotterdam refinery with partners. Green H₂ and CCS project at Neste's Porvoo refinery in feasibility phase, selected for EU Innovation Fund grant.



Power-to-X (eFuels)

Technology end-to-end mapping ongoing.



Algae

Technology platform build-up ongoing.



Lignocellulose

Conversion technology alternatives evaluated. Project development ongoing.



Municipal solid waste

Initial assessment of scalable technologies ongoing.



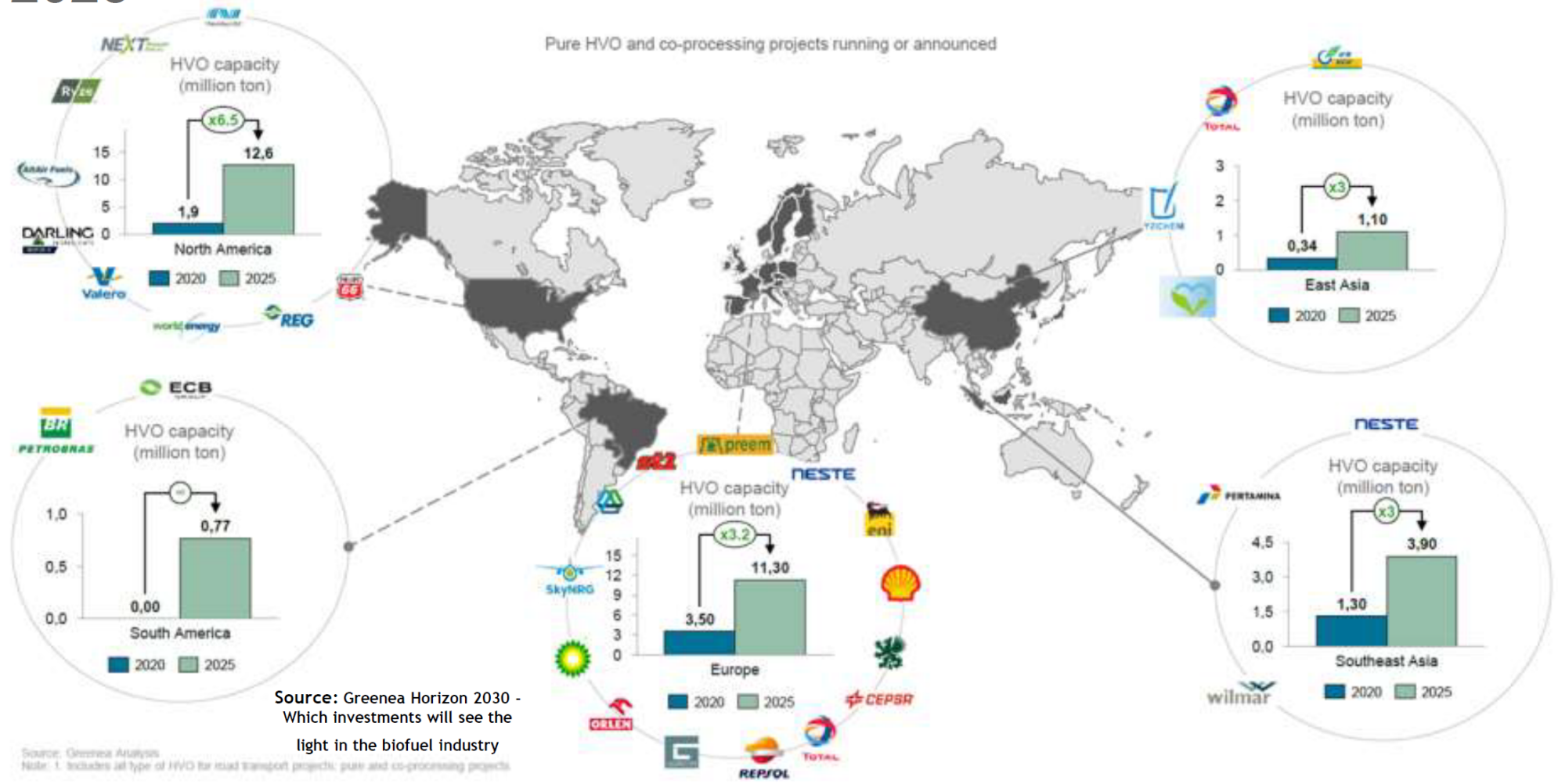
Renewable
aviation

Renewable
polymers and
chemicals

Renewable
road
transportation

Global HVO production is expected to reach 30 Mton by 2025

Pure HVO and co-processing projects running or announced



Why we need a new vehicle CO2 legislation


- Current legislation is not technology-neutral / Science-based
- Risk that climate targets will not be met with only BEV / FCEV approach
- Risk that customer acceptance, infrastructure and availability of green electricity and green H2 will not be available in time in sufficient amounts
- Risk that renewable and eFuels volumes are steered to aviation sector - currently have regulation that recognize renewable and eFuels - missing out on possible volume expansions
- HDV CO2 legislation is translated into other regulations eg. road toll regulations etc. Risk that renewable and eFuels will not be recognized

→ **Need to utilize all renewable solutions**

SOLWIN Refuels

- Partnering with global leaders like NESTE
- Support of reFuels Roadmap (Baden-Wurttemberg/ BW)
- Biofuels Schweiz

BW reFuels Roadmap


Baden-Württemberg
MINISTERIUM FÜR VERKEHR

Roadmap für reFuels für Baden-Württemberg

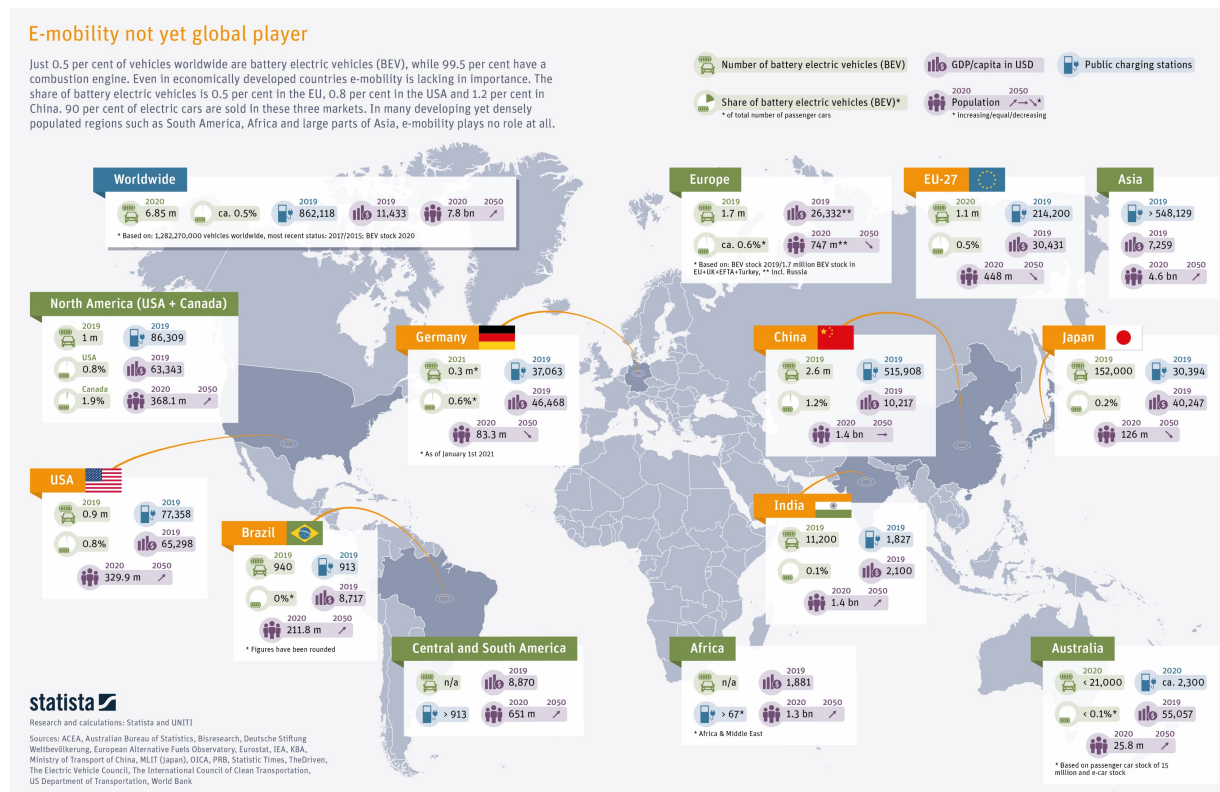
Dr. Uwe Lahl, Ministerialdirektor
Ministerium für Verkehr
Dr. Monika Herrmann, Leitung Projektgruppe reFuels
Stuttgart, Februar 2021

Mobilität und Lebensqualität.
Für Stadt und Land.

SOLWIN 1.5

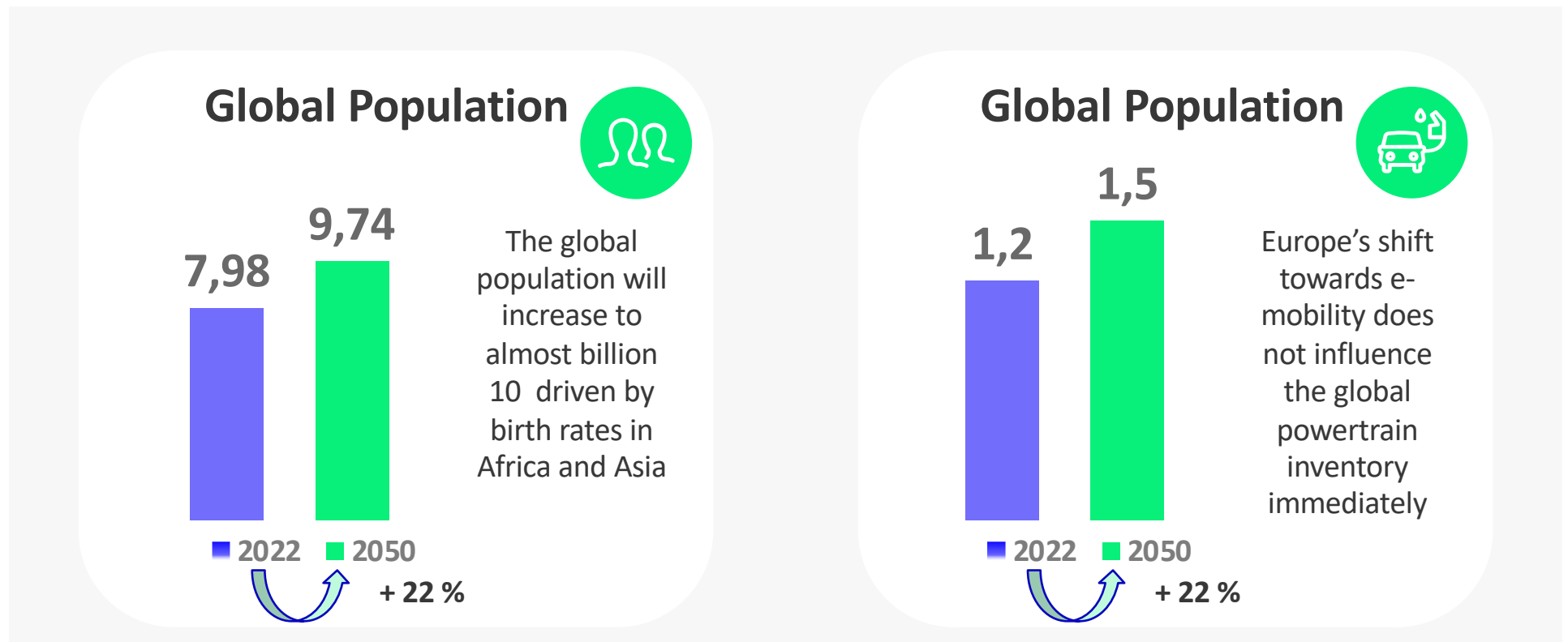
E-Mobility around the world

Overview of BEV market share and public charging stations around the world

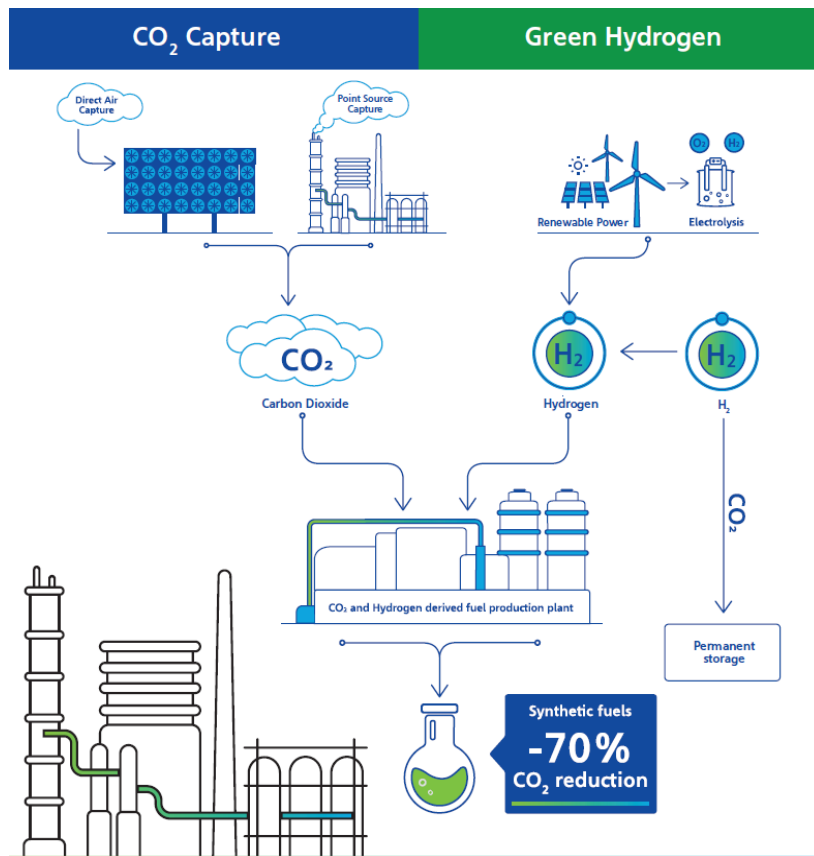


The global growth of the world population and ICE vehicles

The global population growth and vehicles with ICE present an interesting business case for E-Fuels



Green path of Saudi Aramco's E-Fuel Production



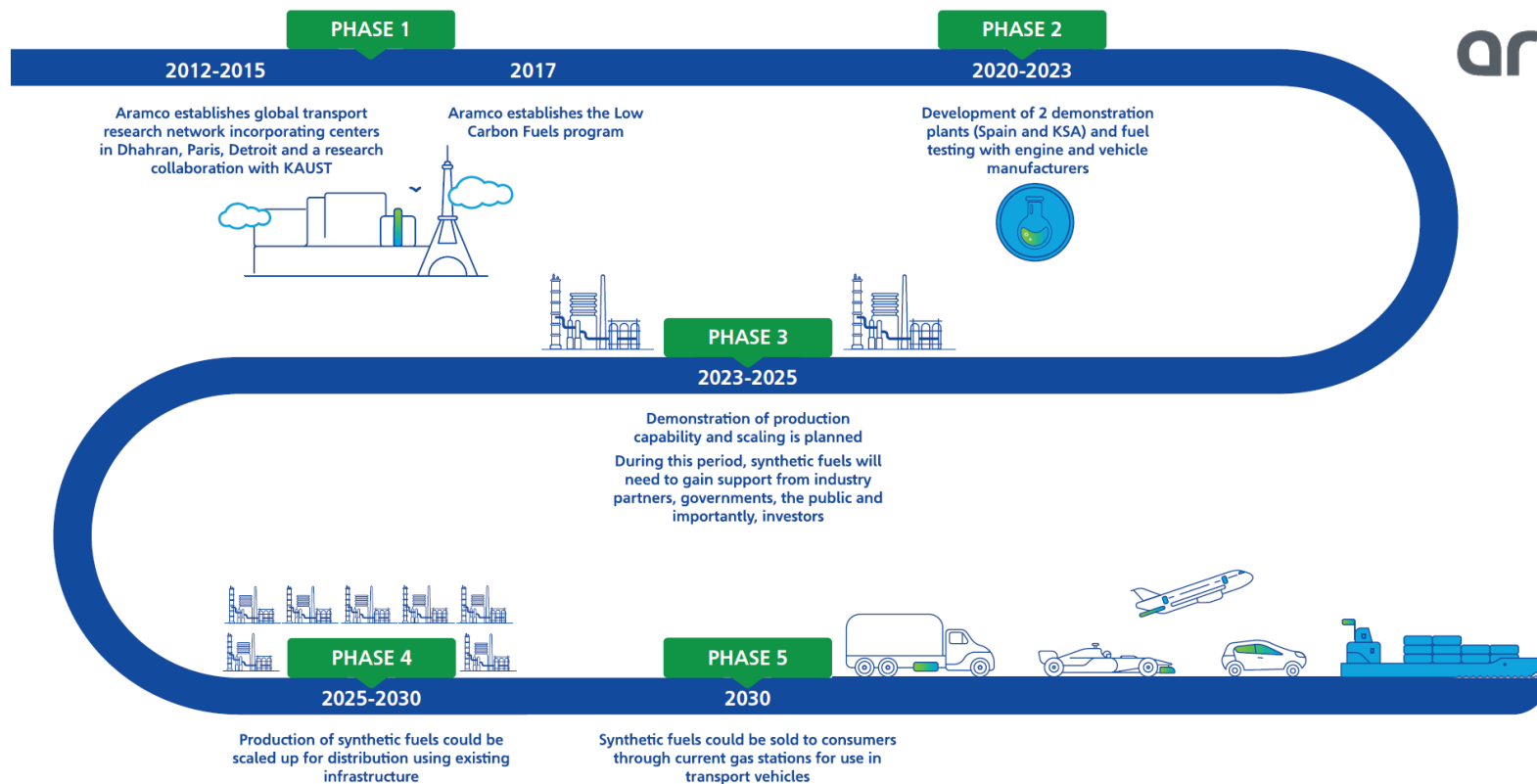
E-Fuels are produced with electricity from renewable energies



No additional food crops or waste is needed for the production process

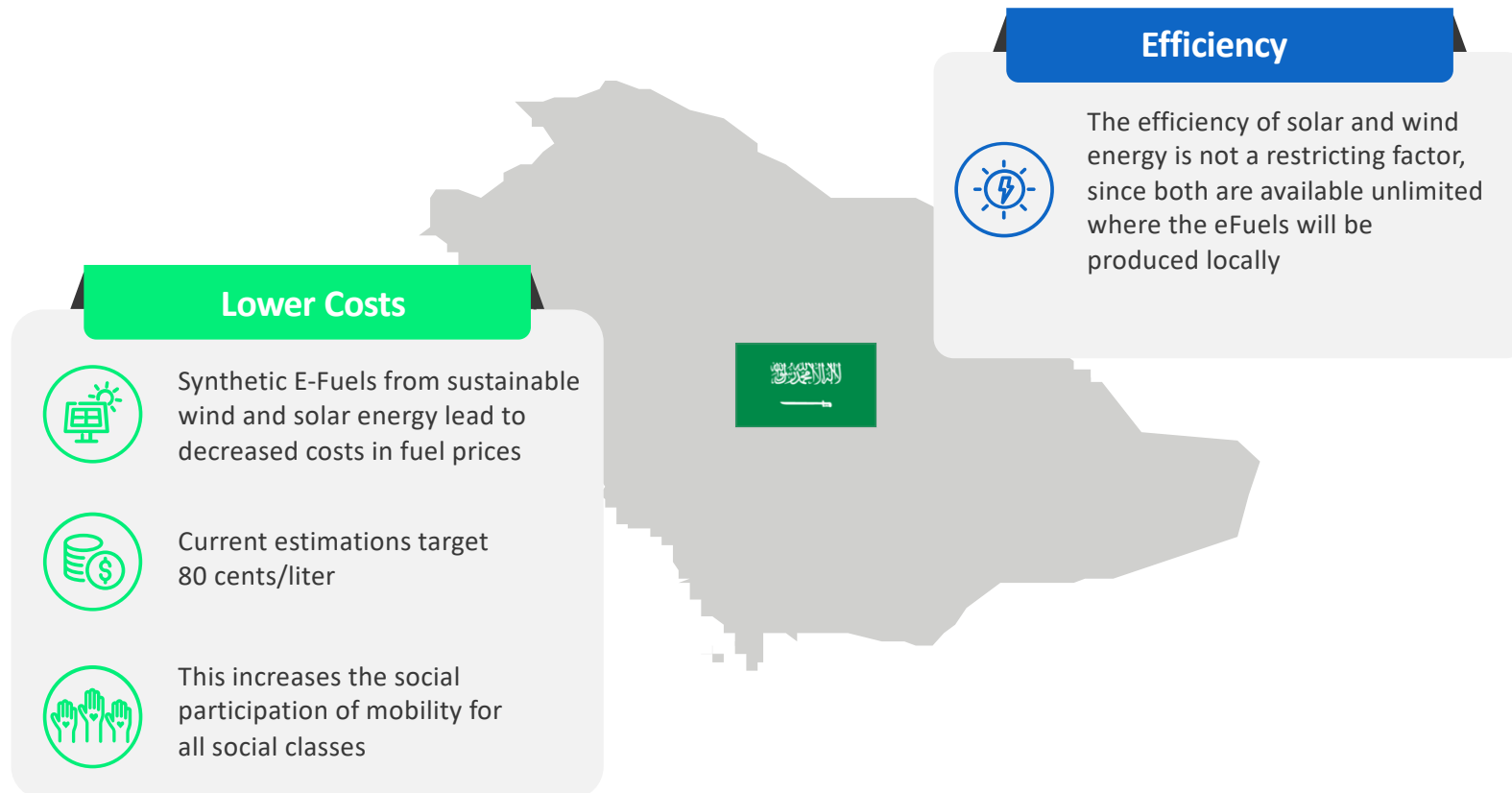


Green path of Saudi Aramco's E-Fuel Production



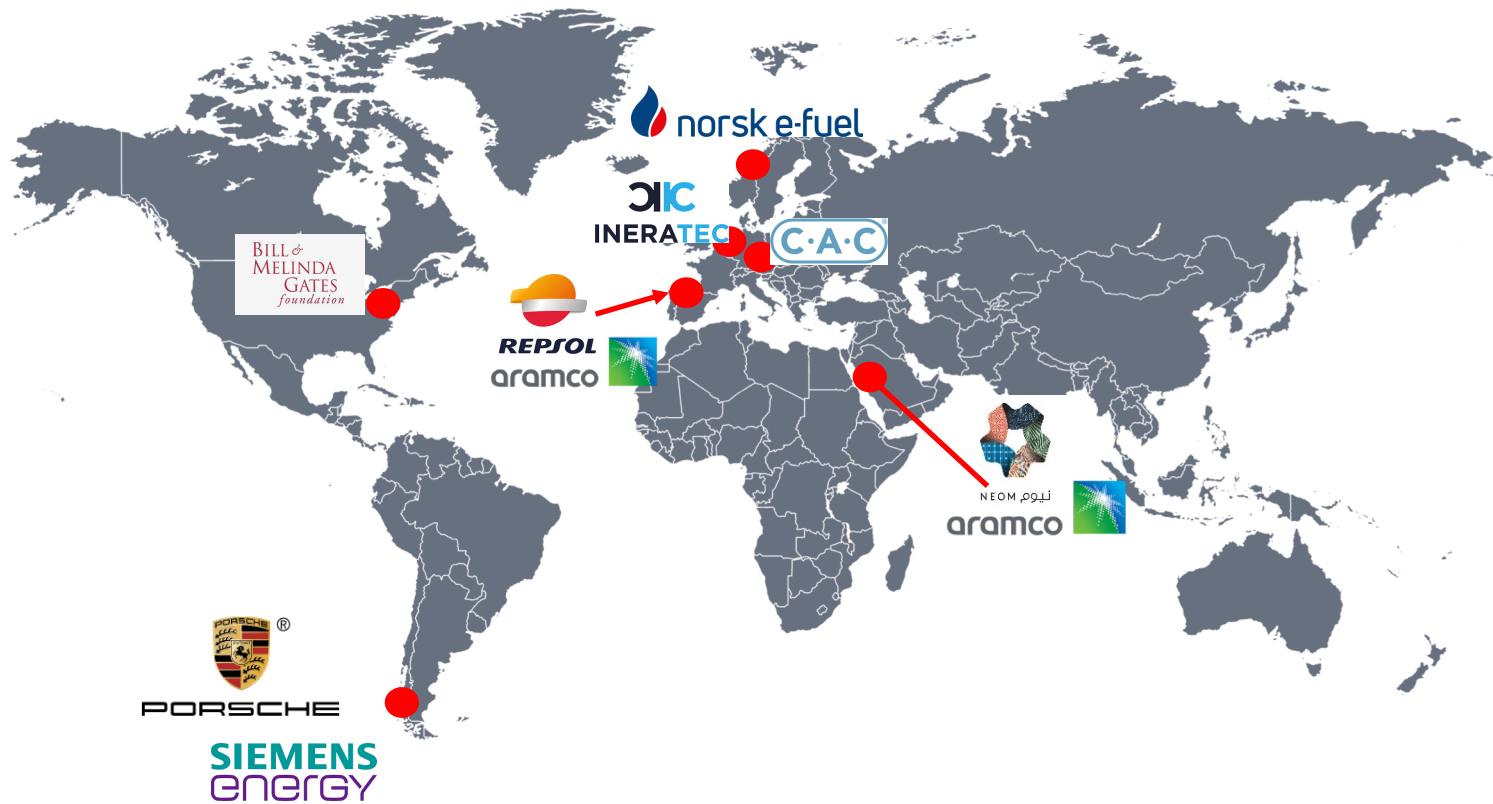
E-Fuels combine two important advantages: lower costs & efficiency

The availability of renewable resources where the E-Fuels will be produced can significantly lower the costs of production

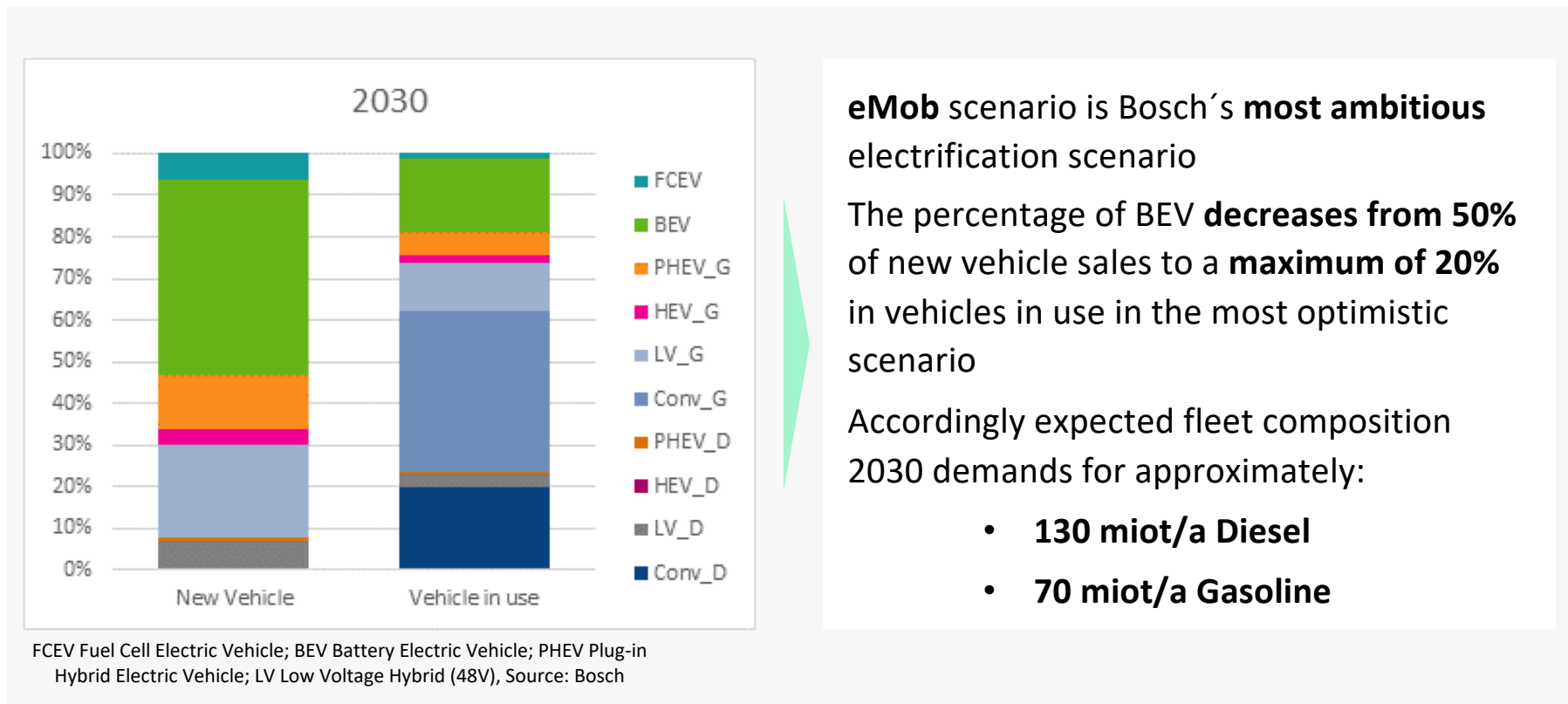


Global E-Fuel Initiatives

Saudi Aramco has two of the few E-Fuels pilot projects in the world



The global shift in powertrains will take decades to reach full effect
 The gap between new vehicles and inventory powertrains on the road is up to 30%



eMob scenario is Bosch’s **most ambitious** electrification scenario

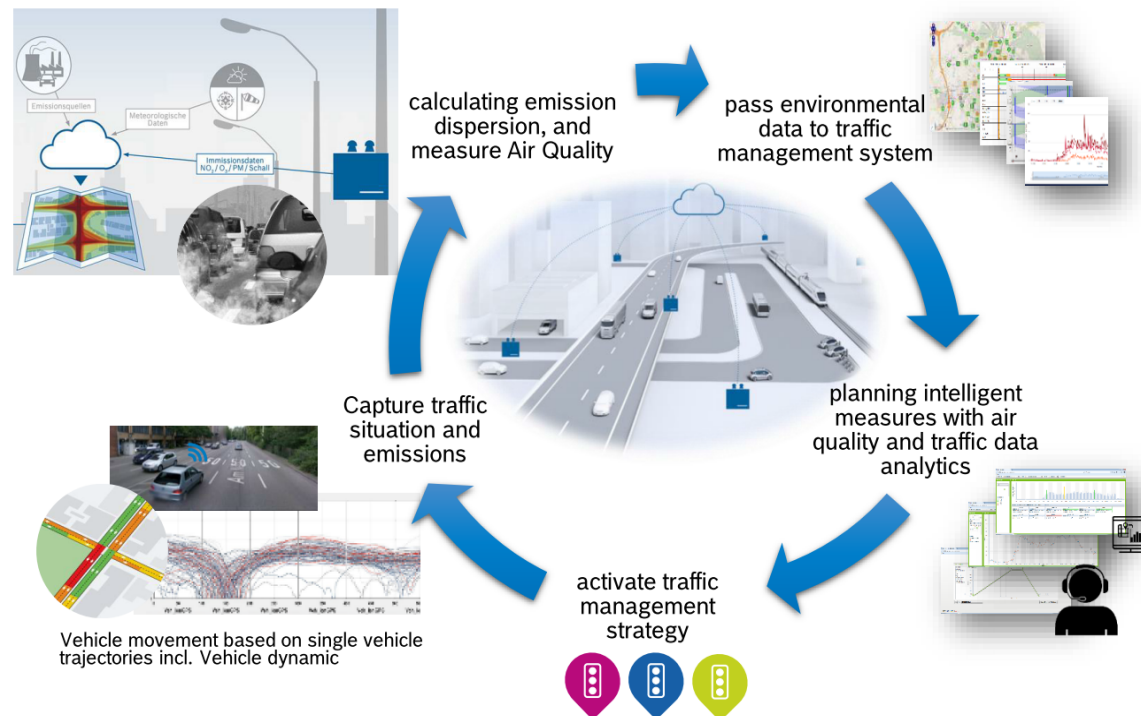
The percentage of BEV **decreases from 50%** of new vehicle sales to a **maximum of 20%** in vehicles in use in the most optimistic scenario

Accordingly expected fleet composition 2030 demands for approximately:

- **130 miot/a Diesel**
- **70 miot/a Gasoline**

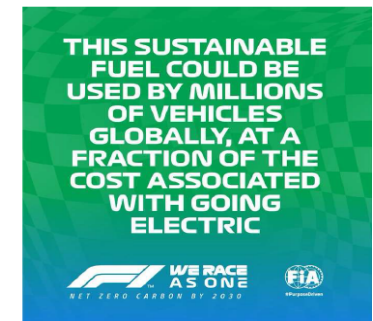
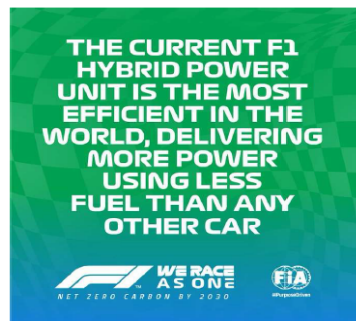
Environmental Sensitive Traffic Management

Bosch data enable environmental traffic management and an unique close loop approach



E-Fuels in F1 and Motorsports

Saudi Aramco is an essential partner for F1 to achieve net zero by 2030



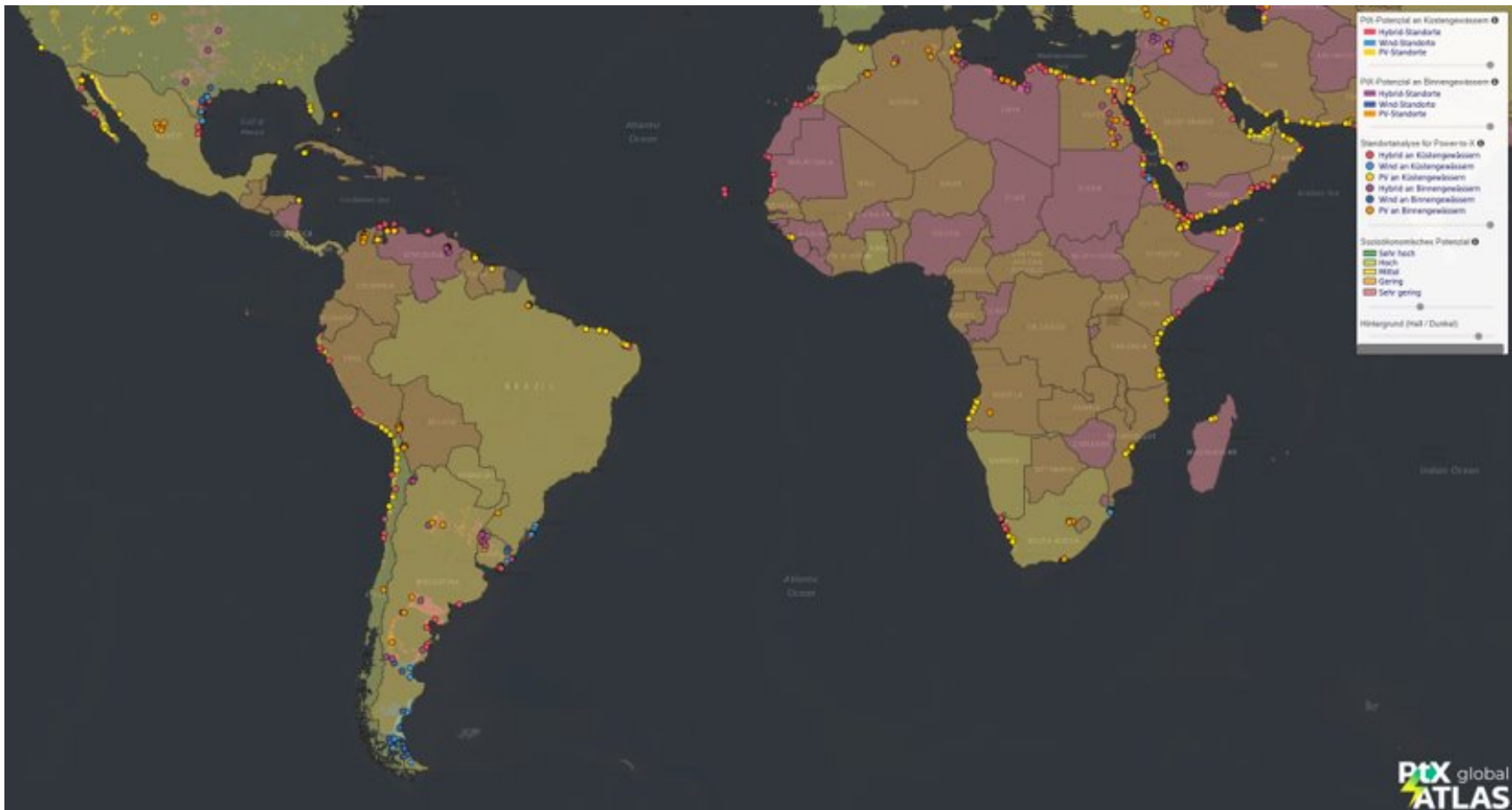
"As you know, we have a global partner in **Aramco** [who] **are being absolutely instrumental in this programme**. That's the largest oil company in the world who are putting really very considerable resources into a programme like Formula 1. Reaching F1's net-zero target by 2030 will be very tough. **The synthetic fuel route is the correct one for Formula 1** despite the growing popularity of electric road vehicles. I'm not totally convinced that electrification is the only answer."



Energy Partnership with USA Delegation and HIF Global LLC



Power to X Plants in Africa and South America



SOLWIN Programm

Initiatives

- 1.5
- *BEST (Bev Eu Strategy)*
- *Hydrogen*
- *Scaling*
- *Viale*

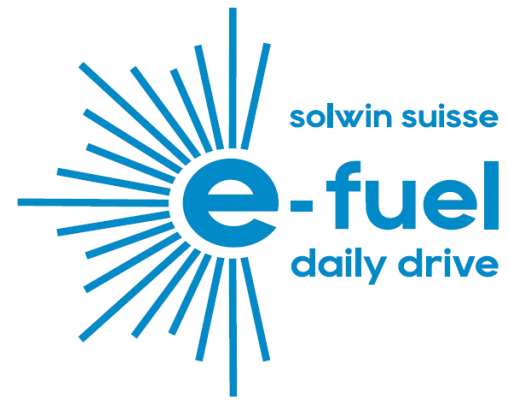
Exchange platforms

- *ALD (Autoland Deutschland)*
- *B(erlin)-Circle*
- *Campus*
- *eLOUNGE*

SOLWIN BEST (Bev Eu STrategy)

SOLWIN Suisse

Foundation of Solwin Suisse starting Q3 2022
Including Racing trophy and daily drive



SOLWIN Suisse

SOLWIN CH Network/hosts

- ACS, SHVF, TCS
- **Autobau Erlebniswelt**
- Avenegy, Avenir, Swissmen
- Biofues Schweiz
- Emil Frey Classics
- ETH Zurich Foundation
- Luzern (Swiss Classic World)
- Motorworld Kemptthal
- Powerfuel Conference (Quade & Zurfluh)
- Press: Umwelt Zeitung etc.
- **St. Moritz (ISAW)**

Glossary

CSS	Carbon Capture Storage
GW	Gas & Water
HDV	Heavy Duty Vehicles
IPCE	Important Project of Common European Interest
PPA	Power Purchase Agreement
PTX	Power to X
PV LCOE	Levelized Costs of Electricity
RED	Renewable Energy Directive