

Towards A Carbon Free Future

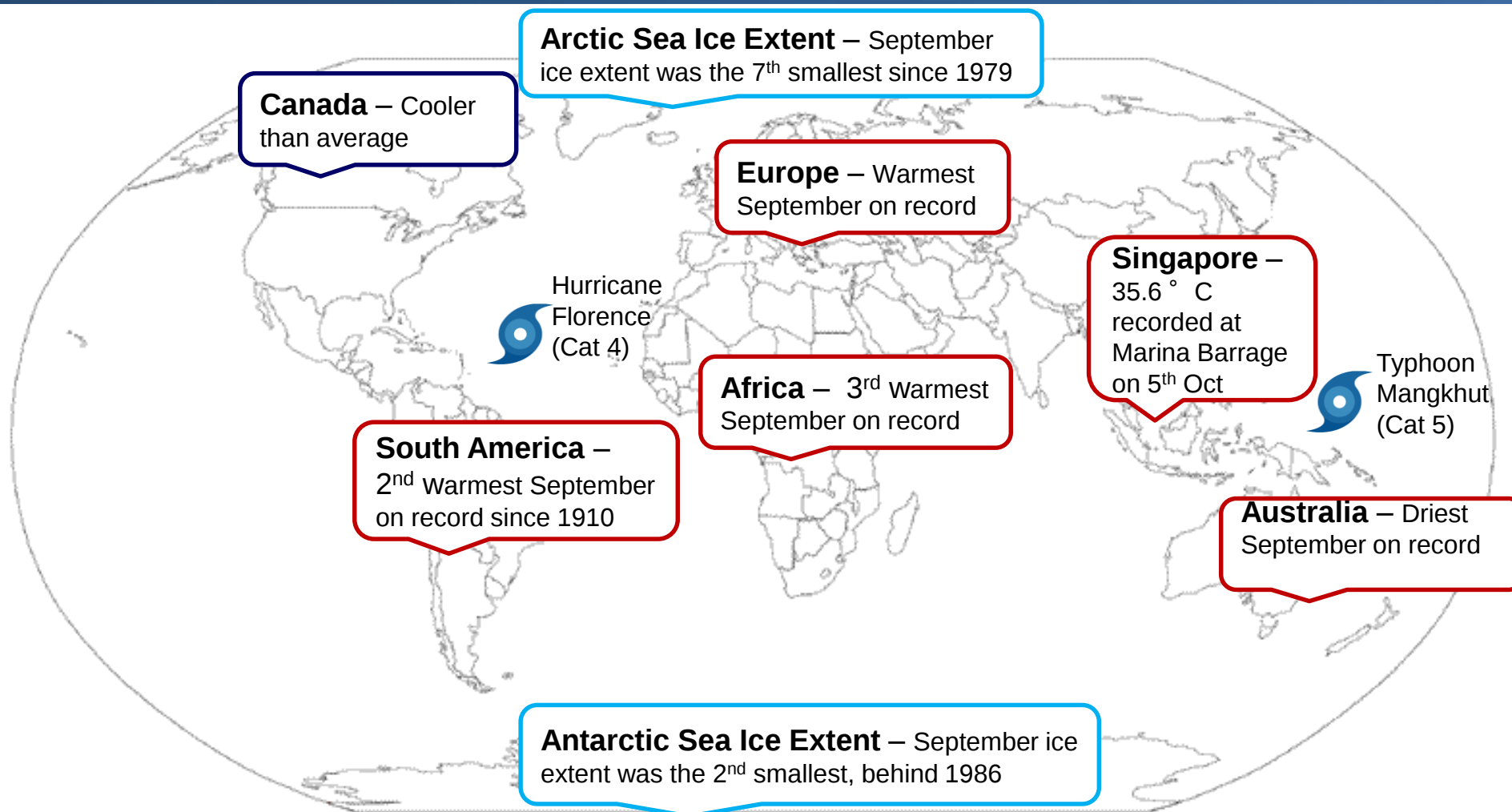
The Challenges & Opportunities

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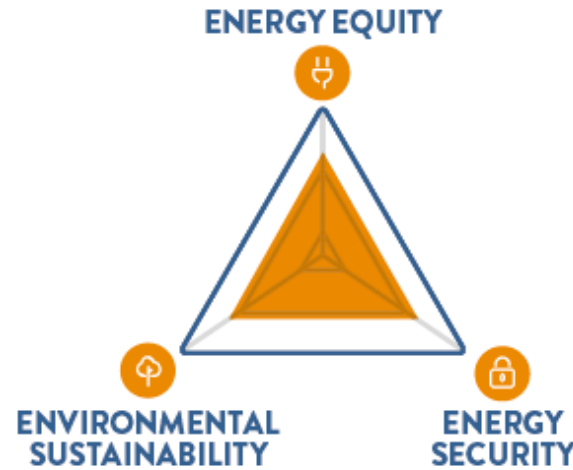
Energy Research Institute @ Nanyang Technological University

Selected Recent Climate Anomalies and Events



IPCC recent report states that the planet could surpass 1.5 ° C marker as early as 2030 and no later than mid-century

Energy Trilemma Index



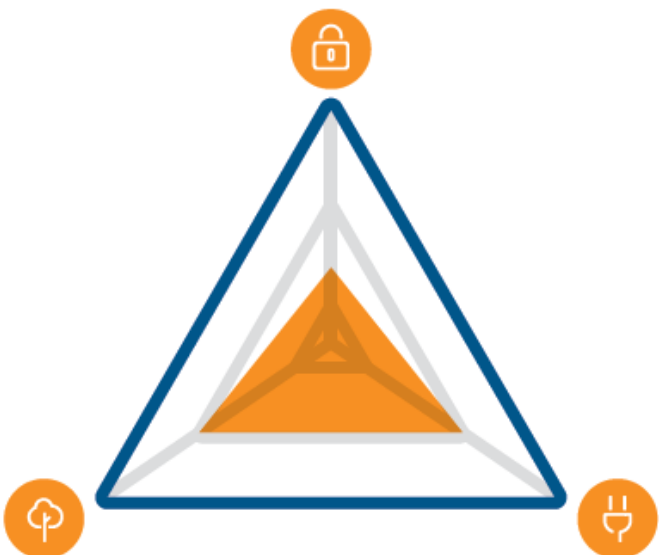
Energy security: Effective management of primary energy supply from domestic and external sources, reliability of energy infrastructure, and ability of energy providers to meet current and future demand.

Energy equity: Accessibility and affordability of energy supply across the population.

Environmental sustainability: Supply- and demand-side energy efficiencies, and development of energy supply from renewable and other low-carbon sources.

Contextual performance: Elements that enable countries to effectively develop and implement energy policy and achieve energy goals

Energy Trilemma Index - Asia

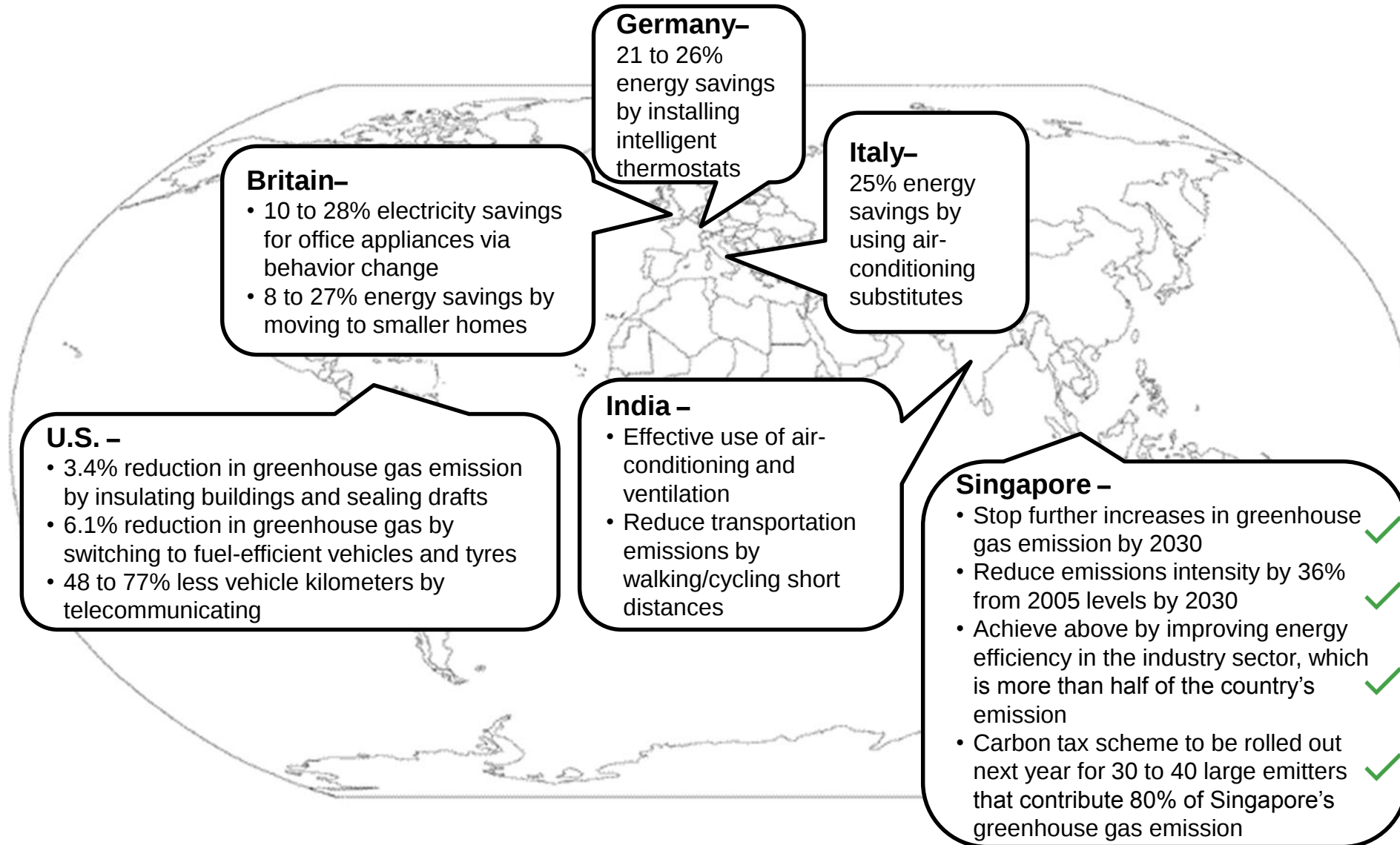


Asian Countries

Australia (38)	Japan (30)	Pakistan (103)	Azerbaijan (27)
Kazakhstan (72)	Philippines (74)	Bangladesh (107)	Korea (35)
Singapore (19)	Cambodia (117)	Malaysia (37)	Sri-Lanka (89)
China (78)	Mongolia (111)	Tajikistan (92)	Hong Kong (34)
Nepal (118)	Thailand (75)	India (88)	New Zealand (8)
Vietnam (83)	Indonesia (71)		

- Asia accounts for ~ one-third of global GHG emission (more than EU and US combined)
- Asia has the world second largest population without access to electricity
- Rapidly growing energy demand, import dependence, trade policies and weather change raises concerns for energy security and energy sustainability
- Singapore ranks 19 out of 125 countries, scoring C A A

IPCC Recommendations



what's
next?



Recent Events



Hydrogen for Future

www.hypothesis.ws

Plenary Speakers



Prof. John W. Sheffield
Purdue University
USA
*"Global trends of
the hydrogen economy"*



Prof. Mao Zhongqiang
INET, Tsinghua University
China
*"Chinese hydrogen situation
and vision"*



Prof. Ken Okazaki
Tokyo Institute of Technology
Global Hydrogen Energy Unit
Japan
*"Pushing forward of
hydrogen road in Japan"*

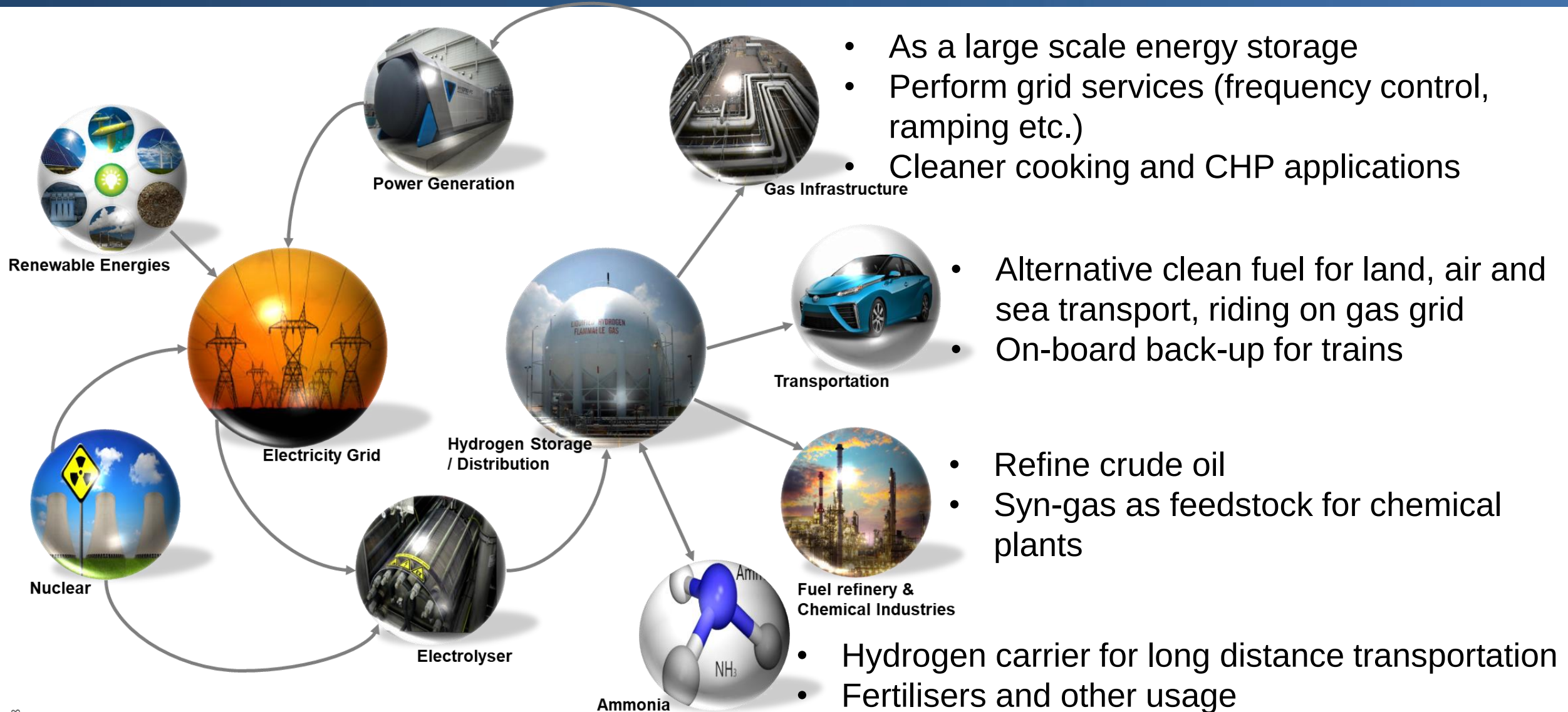


International Symposium

4-Party MOU Signing

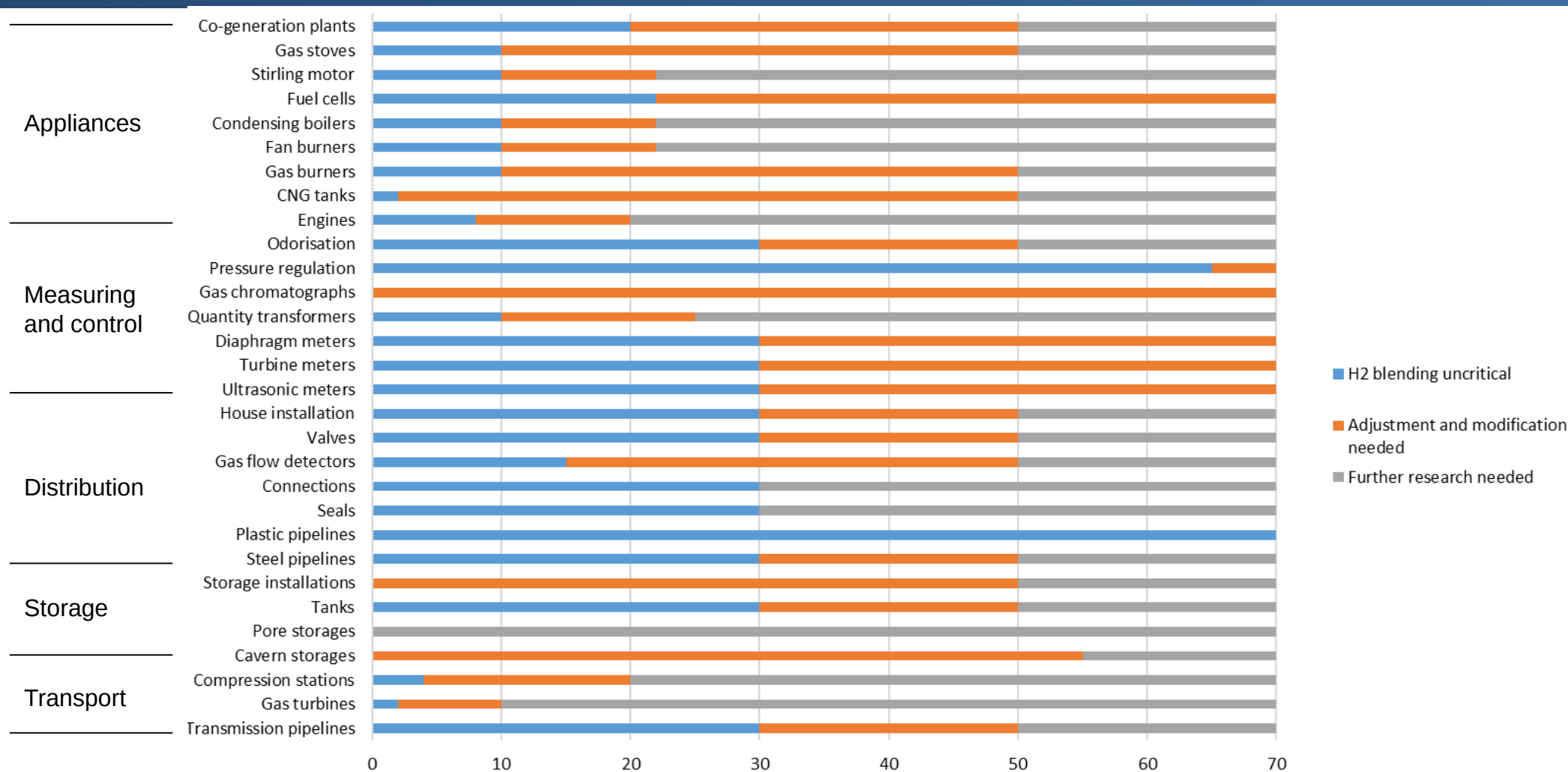
Hydrogen is back!
It's only a matter of time when the use of hydrogen will be widespread.
But how do we adapt to our existing infrastructure?

Hydrogen - A Universal Energy Carrier with Multiple Applications



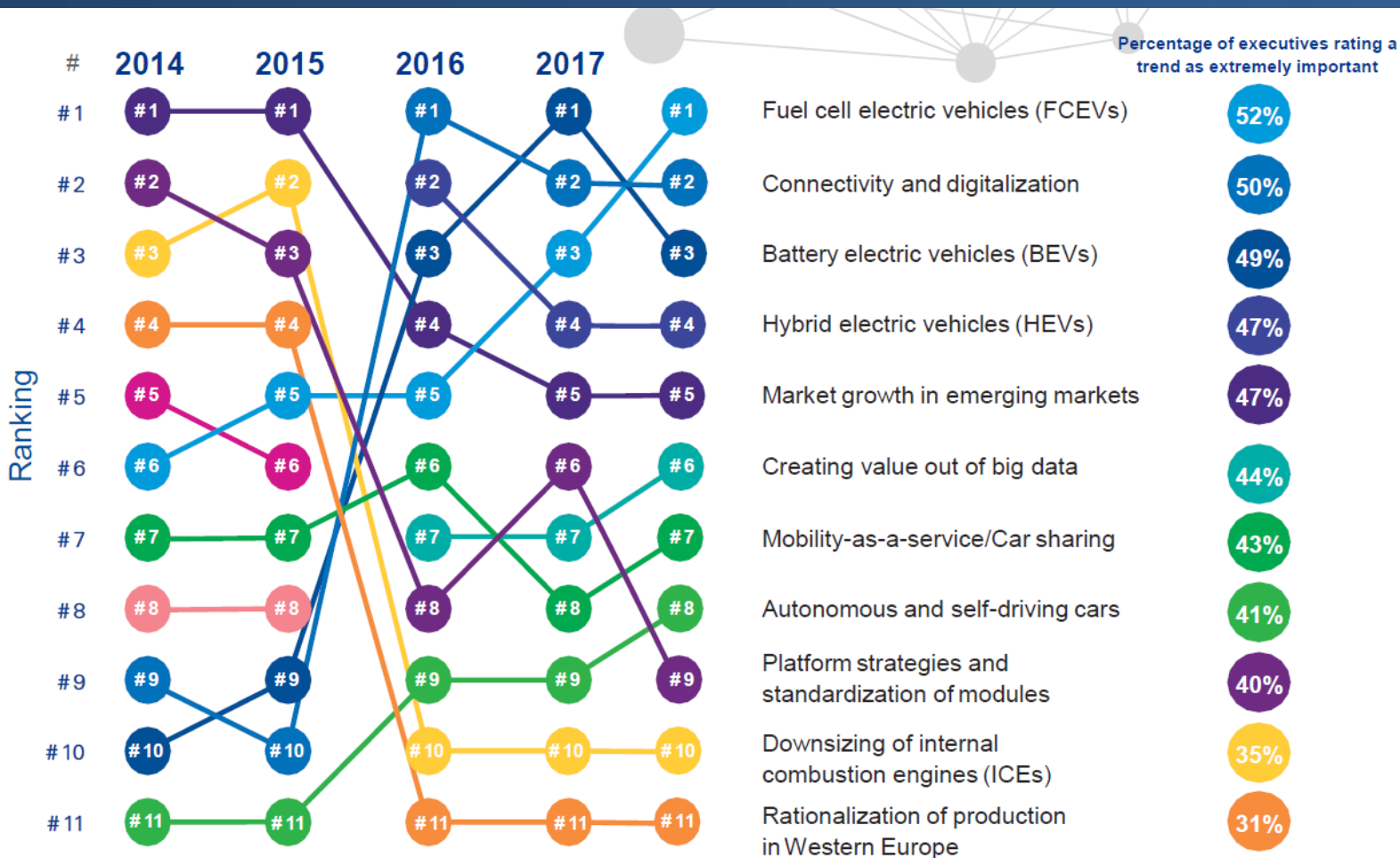
Challenges & Opportunities

Use of Hydrogen in Current Gas Network and Usage



5 to 15 % vol. of hydrogen blending is viable without significant increase in risk associated with gas blend utilisation, overall public safety, or the durability and integrity of the existing gas network

Challenges & Opportunities Transportations



FCVs will lead the trend till 2025



(BEVs) Battery Electric Vehicles

will fail due to infrastructure challenges.

Absolutely agree 22%

Partly agree 40%

Neutral 20%

12% Partly disagree

6% Absolutely disagree



(FCEVs) Fuel Cell Electric Vehicles

will be the real breakthrough for electric mobility.

33% Absolutely agree

45% Partly agree

16% Neutral

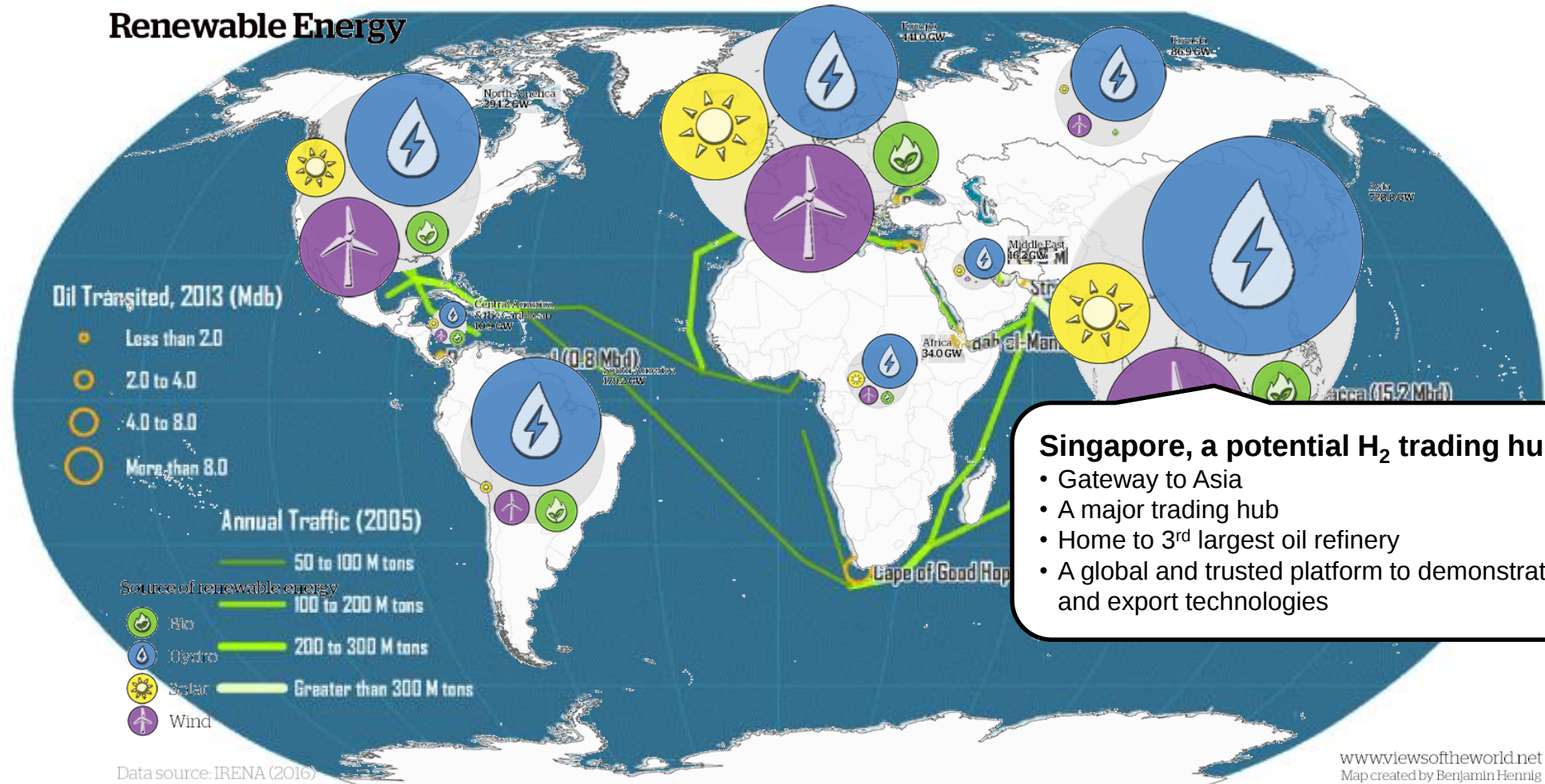
Partly disagree 5%

Absolutely disagree 1%

FCVs has a brighter
future than BEVs

Challenges & Opportunities

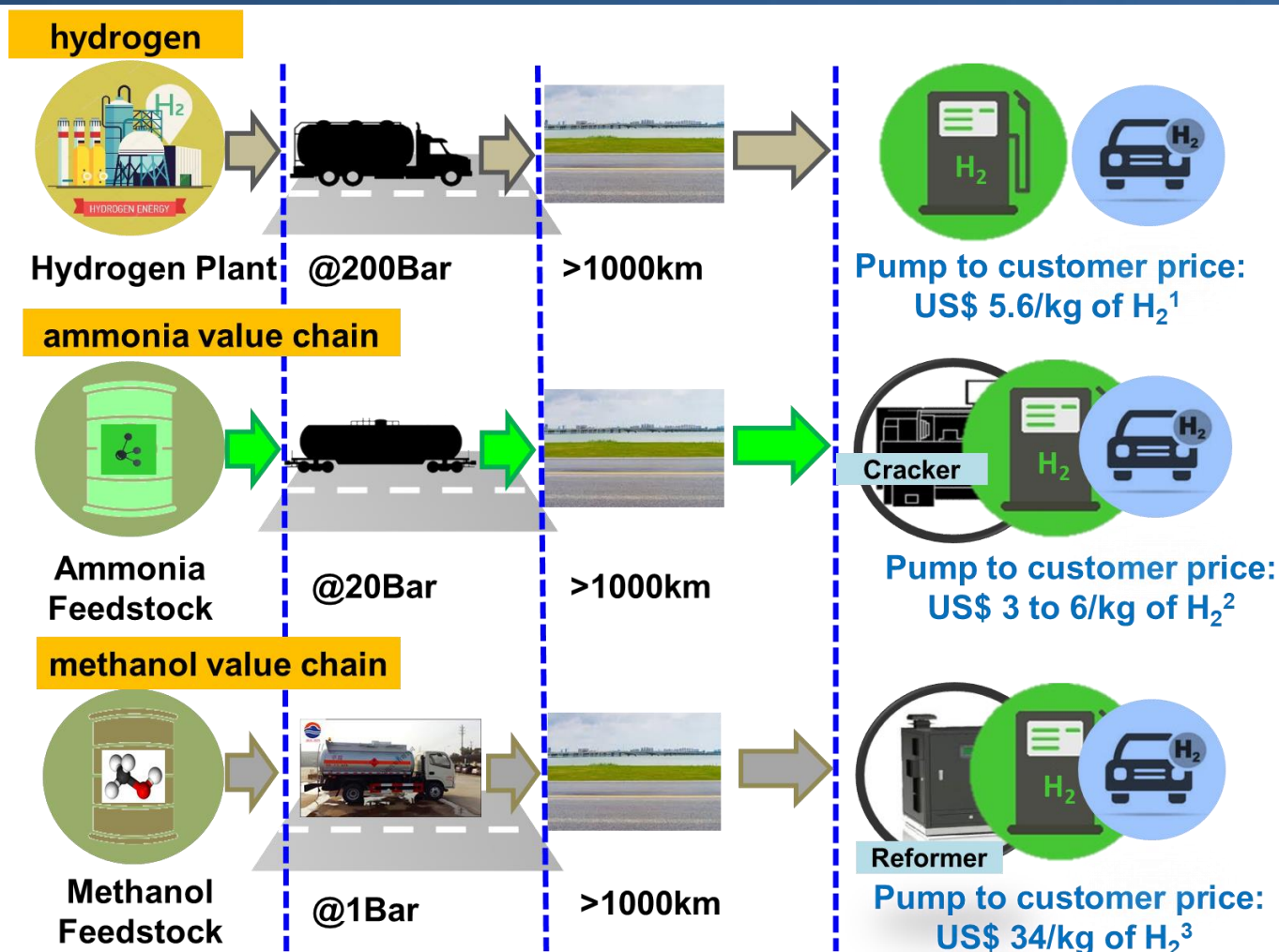
Hydrogen Sources and Transportation



Hydrogen can be the next black gold

Challenges & Opportunities

Hydrogen Sources and Transportation



Hydrogen can be transported in different medium
Price will determine the preferred route

1. Price obtained from interviews conducted with supplier
2. Based on 400 m³/h @ atm, 12 h/day, 365 operation
3. Price obtained from supplier

High temperature electrolyser

- Highly efficient, durable and cost effective solution to be developed and reach commercial stage

Low temperature electrolyser

- Durability and cost effectiveness need to be further improved

Safety

- Establish safety guidelines and approach for hydrogen applications

Mindset

- Further education on hydrogen required
- Demonstration project can be a possible tool

Let's work towards a carbon free future

