

Hydrogen Economy Conference (HEC) 2020
2020年氫能經濟會議

Hydrogen Economy 2.0

'Let's change the world together'

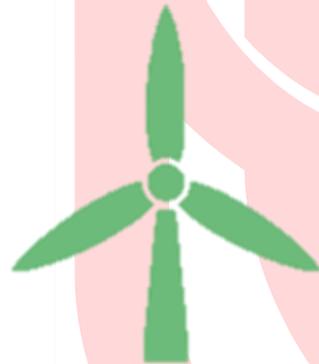
Renewable Energy – Devil in the Details

- China's wind power curtailment dipped to record-low in 2019

1Q19 China



4% (4,350 GWh)

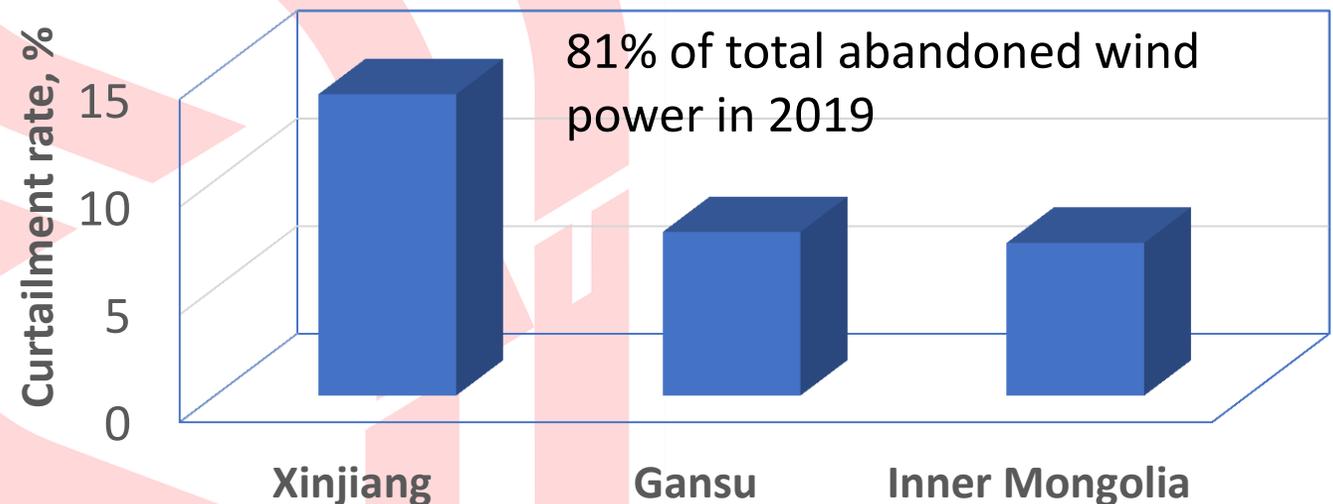


2.7% (1,240 GWh)

Average China Curtailed Electricity
(GWh/month)

1863.3

Curtailment rate – Solar & Wind



Average Hong Kong Electricity Consumption
(GWh/month)

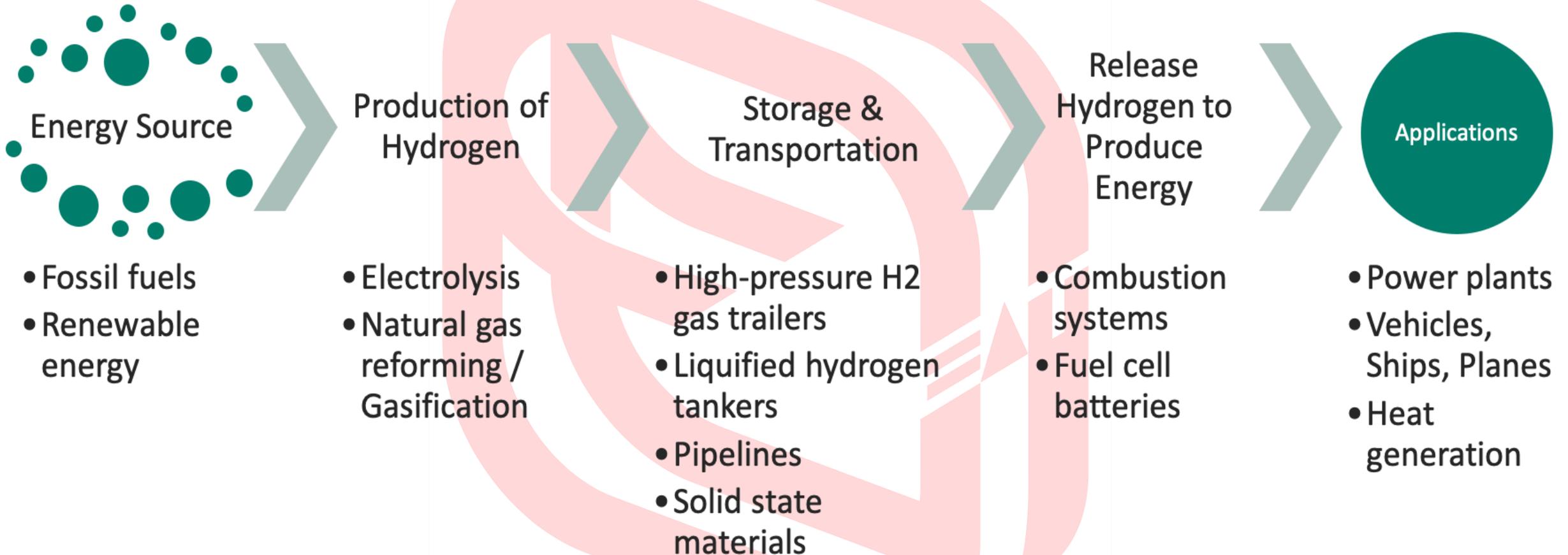
3738.4

Energy Storage Solutions

- Mobile storage
 - Lithium ion batteries
- Stationary storage
 - Flow batteries
 - Pump hydro stations
- Transformative storage
 - H₂ carriers
 - Solid
 - Liquid
 - Gas



Problems with Hydrogen Economy 1.0



The lack of practical solutions in H₂ storage and transportation inevitably led to the pitfall of Hydrogen Economy 1.0 despite significant advancements in H₂ generation and energy conversion.

Technological Breakthrough in Silicon



- Controllable H₂ generation from water or greywater, reaching 14 wt.% with respect to Si
- Na₂SiO₃ is used commercially in formulation of cements, passive fire protection, adhesives, production of silica gel etc.

How 'Green' is EAT Si

Global Warming Impact per Kg of Output

Scenario	Product: Na ₂ SiO ₃ and H ₂ (GWP/kg)
High Voltage Grid	15.06
Wind, >3MW turbine	14.05

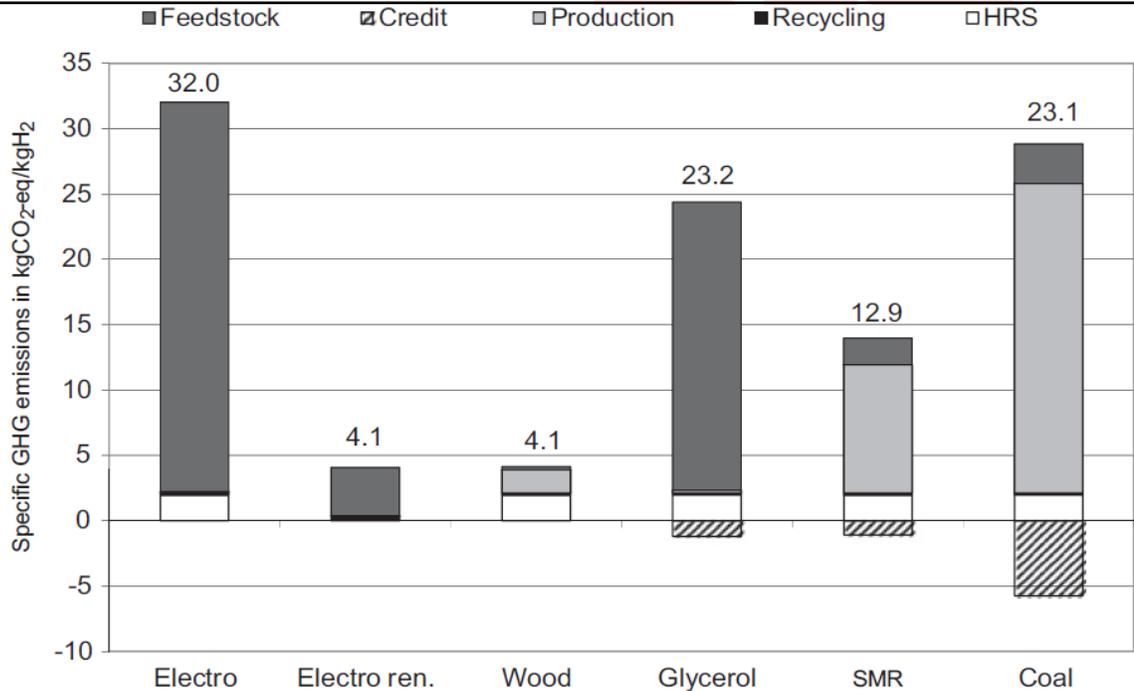
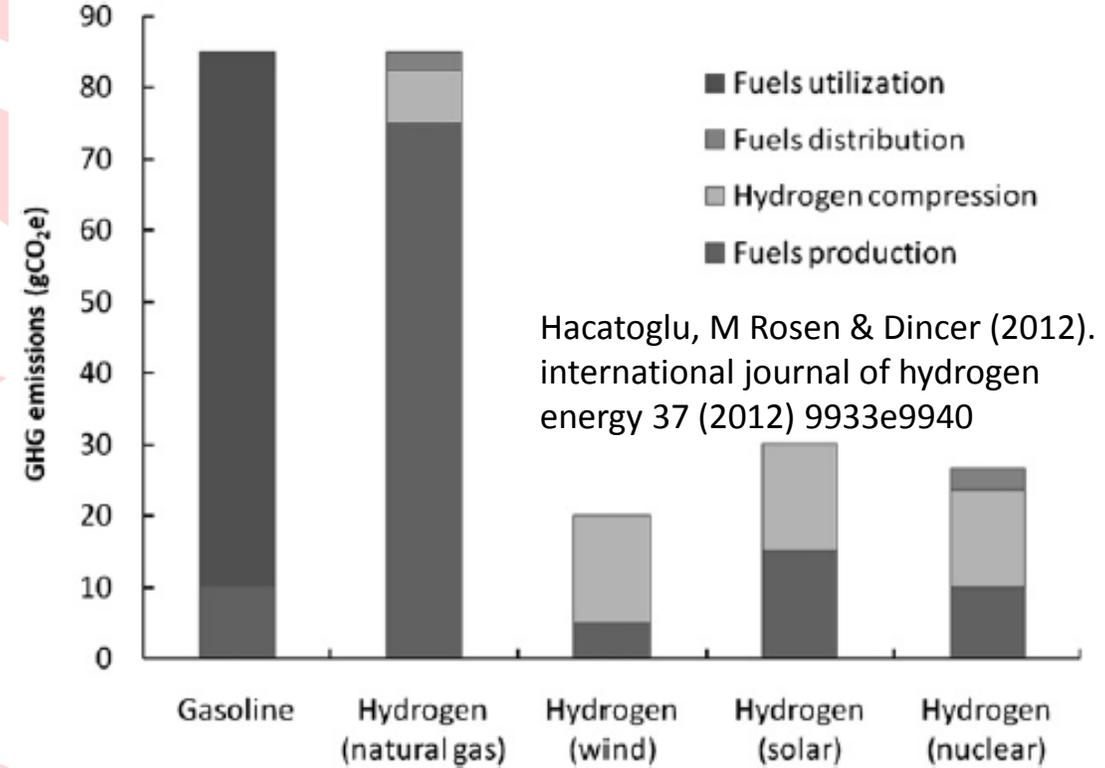


Fig. 8 – Results of the LCA for different hydrogen production pathways.

Wulf, C., & Kaltschmitt, M. (2012). *International Journal of Hydrogen Energy*, 37(21), 16711–16721.



Hacatoglu, M Rosen & Dincer (2012). *international journal of hydrogen energy* 37 (2012) 9933e9940

Fig. 5 – Life cycle greenhouse gas (GHG) emissions accompanying the production and utilization of 1 MJ of fuel (gasoline or hydrogen) in internal combustion engine or fuel cell vehicles. Data for gasoline, natural gas, wind, and solar pathways obtained from Granovskii et al. [11].

EAT Si – Pushing towards Carbon Neutrality

Solved Transportation & Storage issues of Hydrogen Economy 1.0

Average China curtailed wind and solar energy GWh/month	1863.3
Average HK electricity consumption GWh/month	3738.4
GWh consumed to produce 30000T Si /month	~400
GWh generated from 30000T Si *	>100

* Efficiency @ 80% basing on Alkaline Fuel Cell with Combined Heat and Power recovery

Source: <https://www.gencellenergy.com/news/comparing-fuel-cell-technologies/>

Conceptual Containerized H₂ Station

mobile 20" H₂ cartridge
changed twice a week

Estimated system cost @ 6-8M RMB



~3T worth of H₂
20" container

40" container 400 – 650kg H₂/day
station



H₂ dispensing related systems, pressurization,
refrigeration, gas dispensing gun etc.

Ultimate Deep Green Hydrogen Economy 2.0

1. Micro renewable grids, i.e. mobile H₂ stations, to power 21st century smart cities
2. Transportation of EAT Si is equivalent to current fossil fuels
3. Minimize investments in traditional H₂ infrastructure enabling a full transformation into H₂ economy
4. Affordable distributed Green H₂ @ ~\$10-12 USD/kg, has possibilities to further reduce by 20 – 40%

Challenges

- Seeing is believing?
- Breakthrough technology rollout in this complex world
- Competing 'religions and camps' of lithium-ion batteries vs H₂
- Ensuring the Mission and Vision becomes the ethos of the alliance

Our Mission

Enabling the reverse trajectory of global warming by means of the plethora of technologies that we have developed, and preserve The Earth for future generations

Our Vision

The world can be changed by applying our breakthrough energy technologies, and we can achieve this by sharing our technologies to our global alliances to enable the change

Your attention is much appreciated

Let's form an alliance
to change the world!

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