Green Hydrogen Policies: **Current Landscape & Future Directions**



Ministry of Energy and Environmental Sustainability Sarawak

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Songhyun Baik **KEI Consulting**

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Hydrogen Policy Formulation Process

The hydrogen industry is still in its infancy, and governments are driving the hydrogen economy for carbon neutrality

| Recognize barriers | Analyze key factors inhibiting market expansion | | | | Refine inhibitors (barriers) | | | | | |
|---------------------------|--|--------------------------|--|-------------------------------------|---|--|--|---|---------------|--|
| | High cost Lack of deman Lack of infrastr Lack of standa Slower develop Underdevelop | | Cost Demand Infrastructure Standards/Certifications Development velocity Technology | | Global compet Lack of infrasti No hydrogen c Pace of renew | alization of carbon costs titiveness ructure support and dev certification system vable energy dev I Utilization Risk | Lack of su Supply ch Infrastruc Cross-bor Electrolyz Compatib | | | |
| Categorize Action Plan | Key Theme | | | | Key Policy | | | Policy Instruments | | |
| | Overcoming technical constraints | | hnology on and R&D | Financial | support | Assign goals | | &D grants | | |
| | Overcoming commercial constraints | Standards&certifications | | Standard | dards development Authenticat | | on schemes Transportation Sector Technical Stanc | | ical Standard | |
| | | Markets&funding | | | Pricing support Financial su | | | Implementing Carbon Contracts for Diffe | | |
| | | Matching supply&demand | | Assignme | Assignments/Obligations Market desig | | ign Ir | ntroduced heavy-duty trans | portation em | |
| | | | | | | | V | \vee | | |
| Organize Policy | Environment analysis Ca | | ategorize cou | egorize country types Categorizatio | | n by value chain | Categorize by time of y | ear | | |
| | Energy Industry Structure Policy environment Technical environment Geographic environments | | Exporting couImporting couBalancing cou | | ntries | Production Storage / D Utilization | | Market nascent Market growth period Market maturity | ds | |







2 JUNE 10

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- support for production
- chain availability
- icture uncertainty
- order inconsistencies
- zer expansion
- ibility w existing gas distribution

d Definition

Action Plan

erence (CCfD)

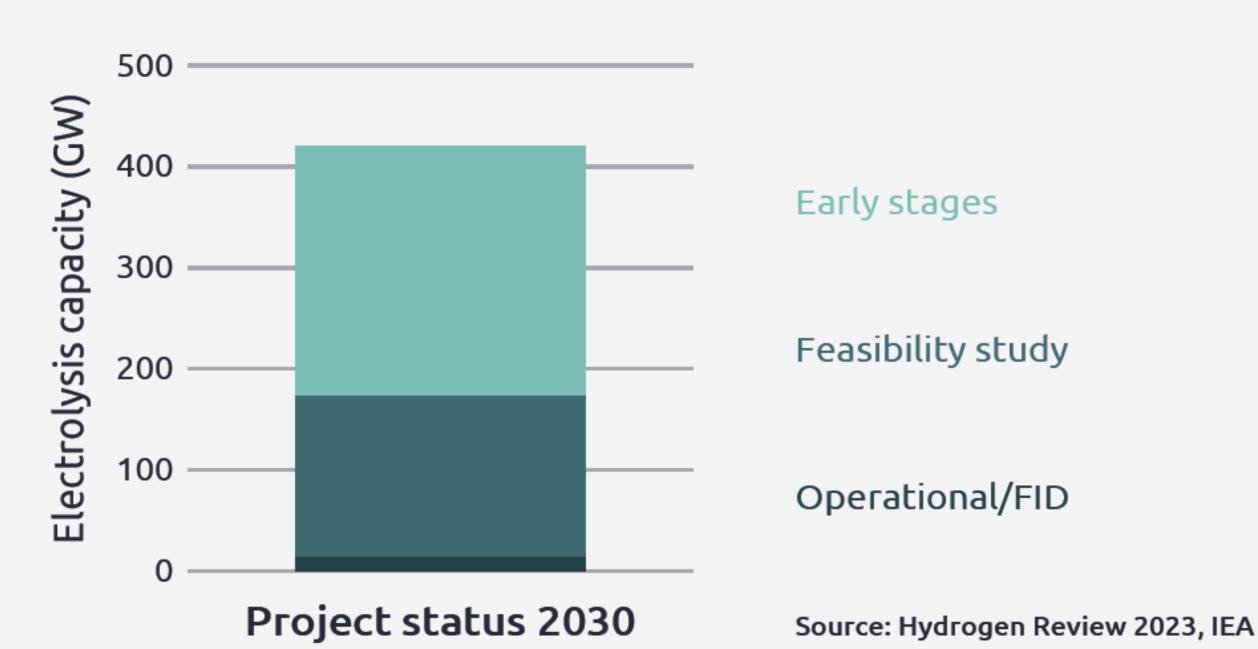
missions targets

Establish Policy framework

By country type

- By value chain
- By time of year

Reaching for Green hydrogen







Getting Tougher to be GREEN

Proposed US guidelines on green hydrogen production tax credit (Dec 2023)

1 Additionality

hydrogen producers to source their power from zero-carbon projects built within <u>three years</u> of the H2 project

② Temporality

calling for renewable power to matched on an annual basis up to 2028, and <u>then</u> <u>hourly from then on</u>

③ Deliverability

green hydrogen projects to be <u>within the same regional grid</u> as the renewable energy projects powering them

"likely to increase project scope and capital costs while reducing efficiency, limiting project credit upside...which elevates counterparty risk"



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- Fitch, Mar 2024

Bold Move to be GREEN

For green hydrogen, we would witness a similar story to that of solar PV – capital intensive. We can reduce cost by scaling up manufacturing of renewable technologies and electrolysers while a bold move is strongly needed

Decarbonization of European Refineries by Green Hydrogen

September 2023, Tender Called

TotalEnergies has launched a call for tender for the supply of 500,000 tonnes of green hydrogen per year by 2030 to replace the grey H2 used at its six oil refineries (and two biofuel refineries) in Europe

June 2024, Off-take Deal Signed

TotalEnergies and Air Products have signed a 15-year agreement for the annual supply in Europe of 70,000 tons of green hydrogen starting in 2030



10 - 12 JUNE 2024

Policy Instruments for Decarbonizing

Green Hydrogen by AMC and Contracts for Difference(CfDs)

Advance market commitments (AMCs) are contractual agreements for the future ulletpurchase of products that are still under development

*Pneumococcal vaccine case: \$1.5 billion pledged upfront to make vaccine affordable (by government funding and donor support) -> Accelerated vaccine rollout by 5 years and saved an estimated 700,000 lives **Frontier, is made up of a group of companies that have committed to purchasing just over \$1 billion worth of permanent carbon removal between 2022 and 2030

| Buyer \$300M Buyer \$200M Buyer \$100M | ↓‡ Frontier Acts on behalf of buyers and suppliers | 6 | Supplier x tons at \$400/ton Supplier x tons at \$300/ton Supplier x tons at \$200/ton |
|---|---|---|---|
| | | | |

Contracts for difference (CfDs) are contractual agreements that pay the difference ightarrowbetween a pre-determined price of a product under development and the market price of that product when it's ready for sale

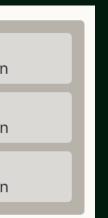
To boost production of low-carbon hydrogen, the EU & U.S. have proposed CfDs and France will be implementing CCfDs starting in 2024





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Electricity Policy for Green Hydrogen

Green hydrogen relies on renewable energy. Green hydrogen production requires an electricity market that can ensure "green" power and renewable PPAs for electrolysers ensure that the hydrogen they produce will be "green".

EU introducing rules to govern green hydrogen and PPAs – PPAs with hourly energy attribute certificates(EACs) or 24/7 clean PPAs – can enable to meet the global standards.

- June 2023, Statkraft' wind power purchase agreement (PPA) will power Air Liquide's new electrolyser plant in Germany to produce green H2 at industrial scale for industry and transport applications
- Oct 2023, German Butendiek offshore wind farm signs green hydrogen PPA lacksquare
- Nov 2023, Kallista Energy will sell wind-generated electricity to green hydrogen producer Lhyfe under a 15-yr PPA that will help secure bank financing to repower the wind farm





Considerations for Green Hydrogen Policy

- A predictable global policy environment
- Regulations and incentive schemes for market creation
- Cost reduction from financing / tariff perspective
- Introducing production-linked incentives for equipment manufacturing
- Enabling faster permitting for renewables



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a global green hydrogen hub



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