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Epistemology of Net Zero, Financing a Faster Transition – Decarbonizing with Clean Hydrogen by 2035

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ABSTRACT:
Climate scenarios and extreme weather surprises strongly suggest that faster energy transitions are necessary IF we are to stay below a 1.8° Celsius rise by 2050 and bend our carbon curve. A review of efforts to decarbonize heavy industry with cleaner hydrogen involves significant capital investment, continued R & D, and a refiguration of our energy supply chains. Our current investment typology and funding structure – in spite of COP28 pledges -- does not have the capacity to provide up to $13 trillion for hydrogen over the next five years, or more for our electrical grids. We need to configure a flexible – heterogenous -- investment framework to accelerate our energy transitions. Much like the Marshall plan, a focused energy bank using clean hydrogen as an illustrative case study shows the investment funds required to build a more decarbonized world by 2035.

Keywords: COP targets, IPCC assessments, energy transitions**,** financial risk mitigation, funding gaps, green and blue hydrogen, scenarios.

NOMENCLATURE

BP British Petroleum, CO2 carbon dioxide, CCUS carbon capture utilization storage**,** IEA international energy agency, IPCC intergovernmental panel climate change, GHG greenhouse gas, NOC national oil companies, IOC independent oil company

1. INTRODUCTION

Our worlds are going through epochal changes that are hard to imagine or model. The political power realignments are shifting in ways that our 20th century institutions are ill-equipped to accommodate. The warming climate and weather crises are testing our ability to prepare for tomorrow’s surprises. Average global temperature increases of 2 degrees C are in the opinion of many baked into our current economies. Our capacity to transition quickly from an 80% fossil fuel world economy to a 40% sustainable net zero economy within fifteen years without major disruptions seems unlikely. HYDROGEN is a promising decarbonizing alternative that many are pursuing. (see reports by DIW, IEA, IPCC, Irena; see 2, 11, 12 and 13).

The challenges for our world structures, governance, financial markets, and how we live are daunting. Of course, our worlds have experienced many seismic changes over the millenniums. Humanism and the Renaissance ushered in a more individualistic form of society; and the Industrial Revolution (1700s) with competing nation states, fossil fuels, and urban migration created prosperity along with numerous social challenges. The 20th century with its world wars, global trade, OPEC, and growing prosperity necessitated a new set of international institutions to navigate the inevitable conflicts and crises (IMF, UN, NATO, World Bank; see 3, 10, 14 on epistemology).

The 21st century confronts dramatic changes in our climate – how and where we live – and huge shifts in how we power our changed worlds. To many it is obvious that 2100 will present a much different world than today. Who will be calling the shots in a heterogeneous multi-polar world is not obvious and what institutions will adapt is critical to our energy futures.

To illustrate the challenges, this paper focuses on one aspect of our energy transition – building a more decarbonized hydrogen-based economy. Creating new markets and governing across borders, accompanied by regulatory agreements that span supply chains / firms is not simple. Transforming hard to decarbonized industries – steel and cement – with regulation, standards, and subsidies must be coupled with significant investment that triples the supply of low

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carbon hydrogen to meet an uncertain market demand. And provides good investor returns by 2035.

The emergence of a clean hydrogen energy sector underscores the need for a heterogeneous institutional funding structure that brings together government, company, and NGO parties who provide

The steady increase in our climate temperatures have been conscientiously modeled and documented over the past two decades by IPCC co-authors. While there remain significant differences in predicted temperature rise based upon various policies many IPCC scientists are pessimistic about our ability to meet the Paris aspirational goals of 1.5^{O}C. (11, 13)

How Likely Net ZERO by 2050?

BP Energy Outlook & Statistics

IPCC report summary

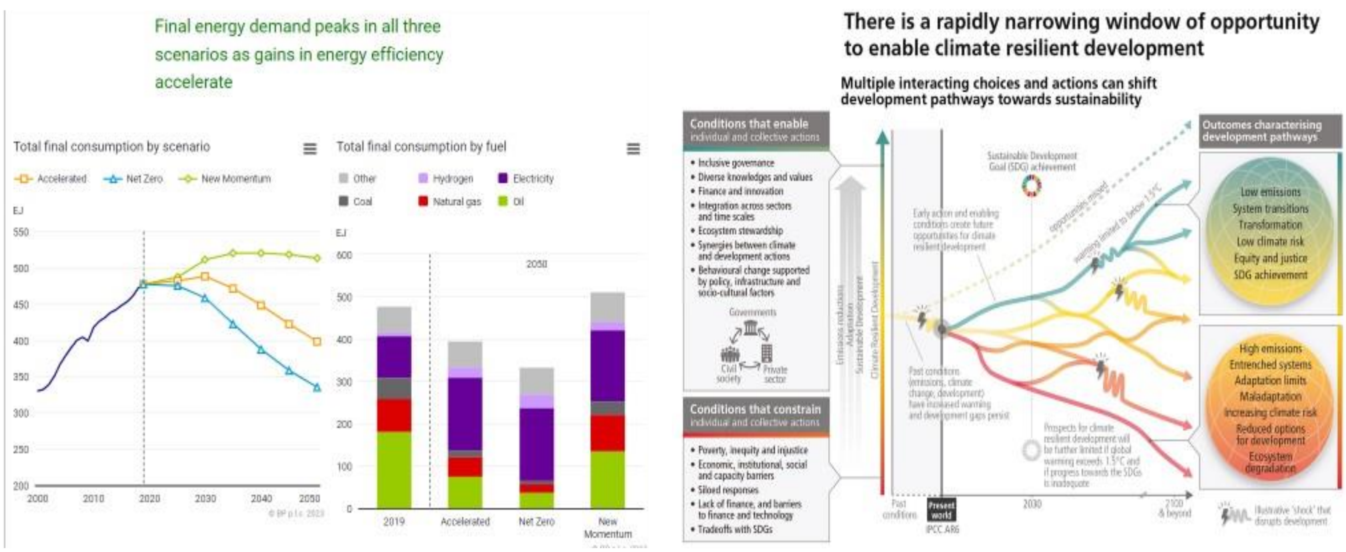


Fig. 1. Net zero transition challenges

technology expertise, money, and governance to a varied set of players. Stakeholders need a roadmap. Some, like Germany and Europe are committed to a more rapid "net zero" transitions due to the disruption of the Ukraine War. Others, like the North America may build upon mature infrastructures through existing supply chains as they develop cleaner hydrogen / ammonia sources. Mena countries with the low cost and plentiful supply of energy sources (oil, gas, sun, wind) are developing a combination of local industries / export-oriented strategies. The hydrogen case study illustrates the multiplicity of paths, the huge investment needs, and shifting institutional financing structure.

2. PAPER STRUCTURE

2.1 Energy & Net Zero.

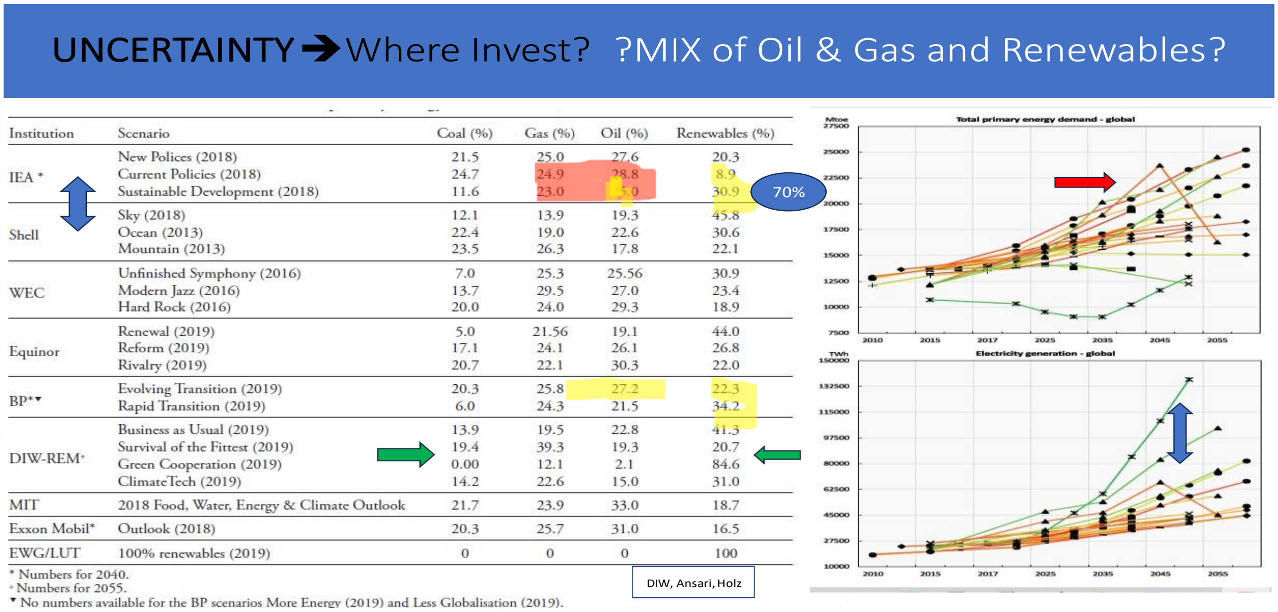
Looking at the climate and energy mix of our changing epistemological world it is clear that time is pressing.

If anything, climate disruptions and temperature rises are coming sooner rather than later. Net Zero by 2050 is a diplomatic way for disparate parties to discuss possibilities over the next 26 years. Not commitments. The BP and IPPC graphs illustrate the dramatic changes in energy demand and mix and the enormous policy challenges that IPCC/COP parties confront (*Fig 1 Net Zero transition challenges*,11, 12). An aspirational dream.

2.2 Energy scenarios

Scenarios have been the empirical tool for producers – first Shell Oil – and policy NGOs like International Energy Agency (IEA) since the late 1970s and OPEC 1 & 2. Today teams of analysts generate varying assumptions to illustrate the challenges of moving our fossil fuel economies to more carbon neutral sustainable paths. The disparate scenarios of our energy futures are striking in their dissimilarities – the DIW graphs show almost 100% variance in energy demand – and for the totally green world, a tripling of electricity grids over the next 30 years. The Net Zero world of IEA paints a doubling of clean energy grids and seventy percent renewable world (*Fig 2 scenario comparisons,* 2, 17, 23).

different regional priorities, and self-interest appears mired in the muck of today. Where we end up is probably in between Survival of the Fittest and Net Zero. Impossible to model, even as we try.



Institution	Scenario	Coal (%)	Gas (%)	Oil (%)	Renewables (%)
IEA *	New Polices (2018)	21.5	25.0	27.6	20.3
	Current Policies (2018)	24.7	24.9	28.8	8.9
	Sustainable Development (2018)	11.6	23.0	25.0	30.9
Shell	Sky (2018)	12.1	13.9	19.3	45.8
	Ocean (2013)	22.4	19.0	22.6	30.6
	Mountain (2013)	23.5	26.3	17.8	22.1
WEC	Unfinished Symphony (2016)	7.0	25.3	25.56	30.9
	Modern Jazz (2016)	13.7	29.5	27.0	23.4
	Hard Rock (2016)	20.0	24.0	29.3	18.9
Equinor	Renewal (2019)	5.0	21.56	19.1	44.0
	Reform (2019)	17.1	24.1	26.1	26.8
	Rivalry (2019)	20.7	22.1	30.3	22.0
BP*▾	Evolving Transition (2019)	20.3	25.8	27.2	22.3
	Rapid Transition (2019)	6.0	24.3	21.5	34.2
DIW-REM⁺	Business as Usual (2019)	13.9	19.5	22.8	41.3
	Survival of the Fittest (2019)	19.4	39.3	19.3	20.7
	Green Cooperation (2019)	0.00	12.1	2.1	84.6
	ClimateTech (2019)	14.2	22.6	15.0	31.0
MIT	2018 Food, Water, Energy & Climate Outlook	21.7	23.9	33.0	18.7
Exxon Mobil*	Outlook (2018)	20.3	25.7	31.0	16.5
EWG/LUT	100% renewables (2019)	0	0	0	100

* Numbers for 2040.
⁺ Numbers for 2055.
▾ No numbers available for the BP scenarios More Energy (2019) and Less Globalisation (2019).

Fig. 2 scenario comparisons

Some transitions appear manageable, others are more disruptive (DIW). The IEA scenarios are generally more prescriptive illustrating what is needed for a sustainable net zero world by 2050; others like the Shell Mountains paint a bumpier, slightly optimistic path with lots of assumptions about how quickly markets/prices/technology do and don't adjust. Then, there are the DIW REM partial (2) equilibrium models laying out the contrasts between the "survival of the fittest" world – where we have continued conflicts, little reduction in carbon emissions, and wealthier countries forging forward; or totally sustainable, fossil fuel free world by 2050 that leverages climate technology, agrees upon common goals, and overcomes differences. How this happens is another question.

Each of these scenarios illustrates a very different story, some with more detail and necessary steps, others with aspiration goals. The huge increase in electricity demand and the transition to cleaner transportation sector (EVs) with more energy efficiency requires huge investments and harmonized goals / standards that seem out of reach. The world of 2024 with continued conflicts,

The scenario exercises paint pictures of possible futures and provide a way to navigate better paths. All the scenarios show us that we need to triple our investment (many trillions) in all technologies, coordinate policies, and prepare for the surprises that will inevitably disrupt our lives. No scenario is clairvoyant, still they help us estimate the investments needed, examine the uncertainty of demand shifts, and review the prices that may make economic sense. Investors need believable assumptions if they are to put down funds to transition to a cleaner energy world. Maybe yes, maybe no.

2.3 Energy prices and cleaner hydrogen:

The hidden subtext of our energy scenarios is price volatility and uncertain profits. High oil prices (over $100) mean other renewable sources are competitive and profitable. Lower oil and gas prices ($70 and below, with gas / LNG under $4 Btu) make the economics of offshore wind, distributed grids, or small nuclear more challenging. We know that price volatility/demand uncertainty is endemic to our energy since 1970s. Consequently, many market players / independent agents are slow to make significant long-term investments or commit to long-term contracts (natural gas and pipelines; Killian et. al, 4, 1) Why invest in new technologies or energy sources if you cannot make solid economic returns in five years? There will be NO significant investment in our futures without political support, regulatory coordination, and subsidies. (18, 24)

compelling. However, the investment needed in existing and new projects, the R & D, and cross border partnerships to reach NZE targets is formidable Up to $3-5 trillion per year (IEA, DVN, Kapsarc, 6, 11, 15,16).

Clean Hydrogen IEA– Trillions of investment next 20 years

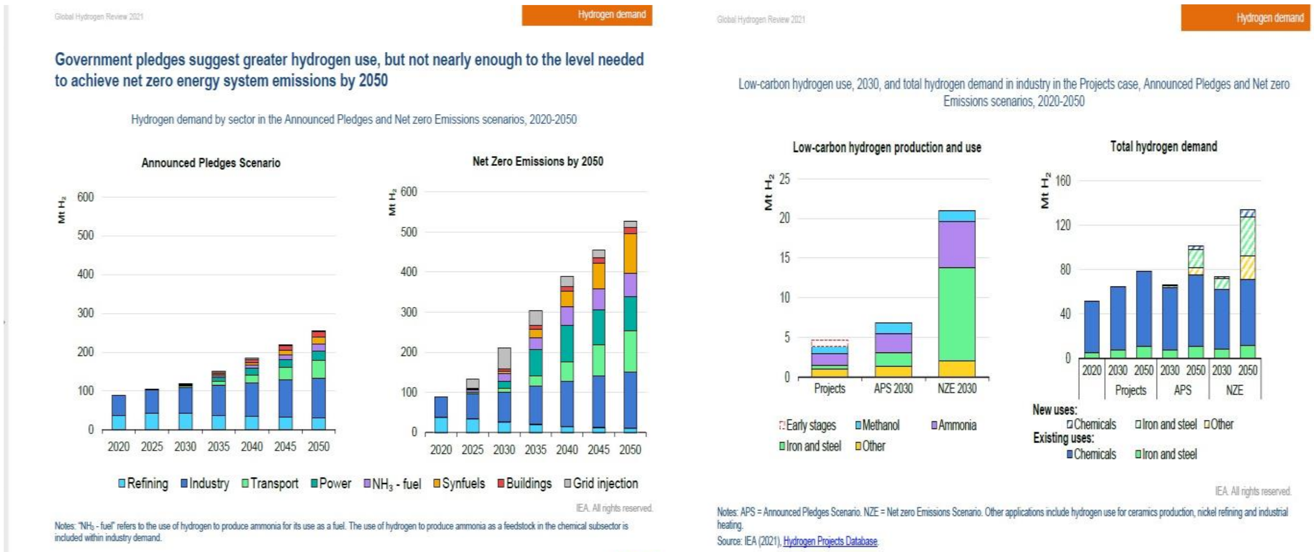


Fig. 3 Hydrogen Investment

Price volatility, long investment cycles, and future profits / returns are inextricably tied up with the uncertainty in our energy scenarios. Which way are we going? Net zero or somewhere between 30 and 60 percent renewables by 2040-50? Price and cost? What roadmap do investors and markets believe?

2.4 Hydrogen investment needs:

Over the past four years surveys and studies (see consulting firms (BCG, DNV, Rystad: 5, 6, 20; Royal Hydrogen Society, 19) have highlighted the high energy content of hydrogen (volume and weight) and clean hydrogen's potential to decarbonize heavy industry and transportation (see IEA, EIA, Royal Hydrogen Society) where there is a need for power / heat intensity and efficiency. Some bullish estimates see the demand for cleaner hydrogen tripling over the next decade with a rapid shift to green hydrogen / electrolysis by 2035. (DNV, Rystad 6, 20) To rapidly increase the scale of hydrogen production, **trillions** of dollars must be invested to supply the emerging end-markets. Multiples of the current levels. (*Fig 3. Hydrogen investment*)

The hydrogen opportunity with high energy content, lower carbon footprint, and energy efficiency is

The cost variations of current hydrogen production technologies -- green to blue -- is significantly more the current production methods (coke, marine bunker fuels, heavy diesel). To expand hydrogen markets so that we reach scale economies, we need carbon (C02) standards, clearly calibrated subsidies, and financial incentives. The transition to a decarbonized economy is expensive.

2.5 Supply.

The engineering logic of decarbonized hydrogen with high energy content is compelling for many developed OECD markets. The logistical challenges of moving quickly to a lower carbon economy are demanding in terms of R & D, reconfigured supply chains, harmonized regulations, information transparency, and market incentives across borders. (DNV, IEA, Oxford; 6, 11, 16)

The other equally challenging side of the hydrogen market is **increasing the supply.** As the market grows, each region (EU, USA, Asia, Mena;) is developing plans with companies, governments, and financial players to invest in lower carbon hydrogen / ammonia. Each region has varying degrees of technical capacity, delivery strategies (pipeline, ships, on site), and policy priorities. How quickly Europe develops higher cost "green hydrogen" depends on both the learning curve advances of green hydrogen and the expanded investments in a much greener grid. Whereas the lower cost of "blue hydrogen" using current technology and

markets (pipeline or ship) that involves another set of infrastructure investments (subsidies) by other players.

Companies and investors need to believe that they can make money and reasonable returns. How do you invest 10 trillion Euro to quadruple the supply of hydrogen by

DNV — Hydrogen forecast to 2050

Figure 5.5 shows levelized cost and its components in four selected regions, which illustrate the trends explained in the preceding paragraphs. The wide spread in costs between regions is due to factors such as differences in local conditions, fuel prices, availability of support, and cost of capital. The differences in regional costs influence regional production mixes as shown in Figure 5.6.

Table 5.1 summarizes the capacity of all electrolysers, dedicated or grid-connected, merchant or captive, in 10 world regions. Greater China, with its high hydrogen

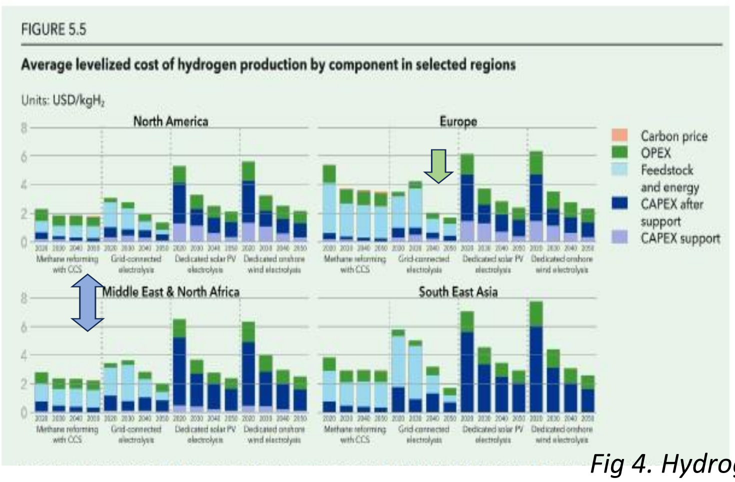


TABLE 5.1

Electrolyser capacity by region

Units: GW

		2030	2040	2050
NAM	North America	10	120	305
LAM	Latin America	4	27	83
EUR	Europe	111	351	574
SSA	Sub-Saharan Africa	4	16	66
MEA	Middle East & North Africa	8	35	147
NEE	North East Eurasia	3	13	22
CHN	Greater China	258	899	1248
IND	Indian Subcontinent	18	80	263
SEA	South East Asia	3	27	123
OPA	OECD Pacific	45	180	244
World		**465**	**1748**	**3075**

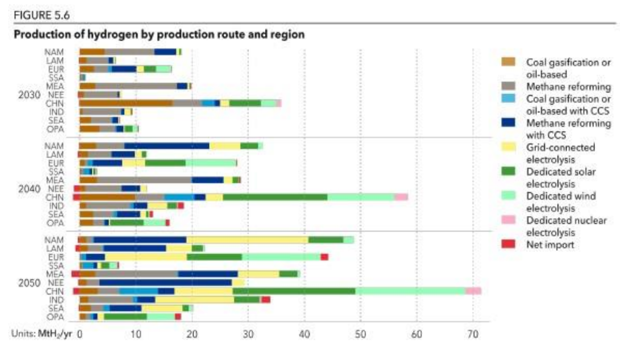


Fig 4. Hydrogen regional costs

large investments in CCUS to reduce the carbon content has immediate price appeal, particularly for producers in North America and MENA countries (DNV 6). Each region has a different set of incentives, costs, and investment timeframe (i.e., IOC and NOC). Of course, they all require greener grids and low-cost ways to transport hydrogen to end users. (*Fig. 4 Hydrogen costs*)

The energy content and technical challenges of "blue and green" hydrogen are striking. The estimated cost differences gathered from surveys and consulting companies with access to propriety data / technical information show significant variances in terms of costs and location (DNV 6 shows a range of costs by region and technology: \$5-6/kgh$_2$ for green to \$2-3/ kgh$_2$ for blue. How quickly the hydrogen market develops very much depends upon the scale of investment, government support and subsidies for higher cost fuel sources (e.g., green auction markets in Germany, 9), evolution of longer-term semi-fixed contracts (e.g., development of LNG) and expanded green grids IF electrolysis is going to reach its potential. And then, of course, you need to transport the hydrogen to end

2035 in some 250 projects across the world? Who will coordinate the process?

2.6 Hydrogen demand:

Let us explore how the EU is creating the demand and investing in hydrogen, particularly when green hydrogen is not the cost competitive source. To support a robust and profitable hydrogen market the EU has outlined its regulations, standards, subsidies, joint ventures, and funding (8).

2.61 In Germany, there is a strong commitment to sustainability with a combination of regulations, subsidies, and carbon targets (e.g., solar, wind, feed in tariffs, with some nuclear). For Germany, decarbonizing its steel and heavy manufacturing capacity is critical to its competitive position in a "post Ukraine War" with less Russian gas / LNG and a non-coke smelting steel industry. Cleaner hydrogen provides the intense heat / energy to make steel however plants and manufacturing processes must be redesigned / reconfigured. Subsidies and known payments are the only way industry will invest.

- To reach its net zero goal, Germany supports slightly higher carbon prices that is consistent EU emission trading system and specific industry carbon targets / regulations that incentivize faster transitions. Carbon pricing and industry CO2 targets is, of course, the preferred market incentive / tax to spur industry investment. Germany industry will be more sustainable and remain competitive if other countries follow the lead. The policy question is what will it cost and how long will it take?
- Given the higher price of hydrogen / ammonia (whether green or some shade of blue with CCUS) compared with coke or gas, various government agencies (DVN, Grimm, Oxford 6, 9,16) recommend, hydrogen auction markets so that subsidies can be estimated and fairly allocated. HOW much and for how long? Some estimate, 2 euros subsidy per unit of energy – twice the current cost -- for ten years. (100s of billions). Declining green hydrogen cost curves may lead to faster transitions particularly if the hydrogen policy is successful. Of course, this requires a tremendous (50-100%) increase in sustainable electricity and a diversified hydrogen supply – no more dependency on one source. (e.g., Russian) /subsidized low carbon fuel sources. Needless to say, repurposing the independent pipelines / energy distribution system also necessitates subsidies and regulatory guidelines, CO2 targets. Investment does not happen without strong nudges.
- Given Germany's experience with feed-in-tariffs and its support of solar and wind indicates that the regulatory agencies understand the challenges of managing the markets and have the capacity to work with industry leaders. However, such processes and transitions come with lots of details, missteps, and a delicate political balance. Energy bureaucrats must study and adjust their directives. German industry and Net Zero coalitions should not get too far in front of its less sustainable EU competitors or hydrogen market prices. *(Fig. 5 Regional decarbonization)*

Supporting a competitive steel / heavy industry market that is fueled by low-carbon hydrogen and electricity takes an enormous transformation of Germany's manufacturing sector. Government / EU policies must attract the capital, technical expertise, and project management skills to make this transition sooner (2035) rather than later.

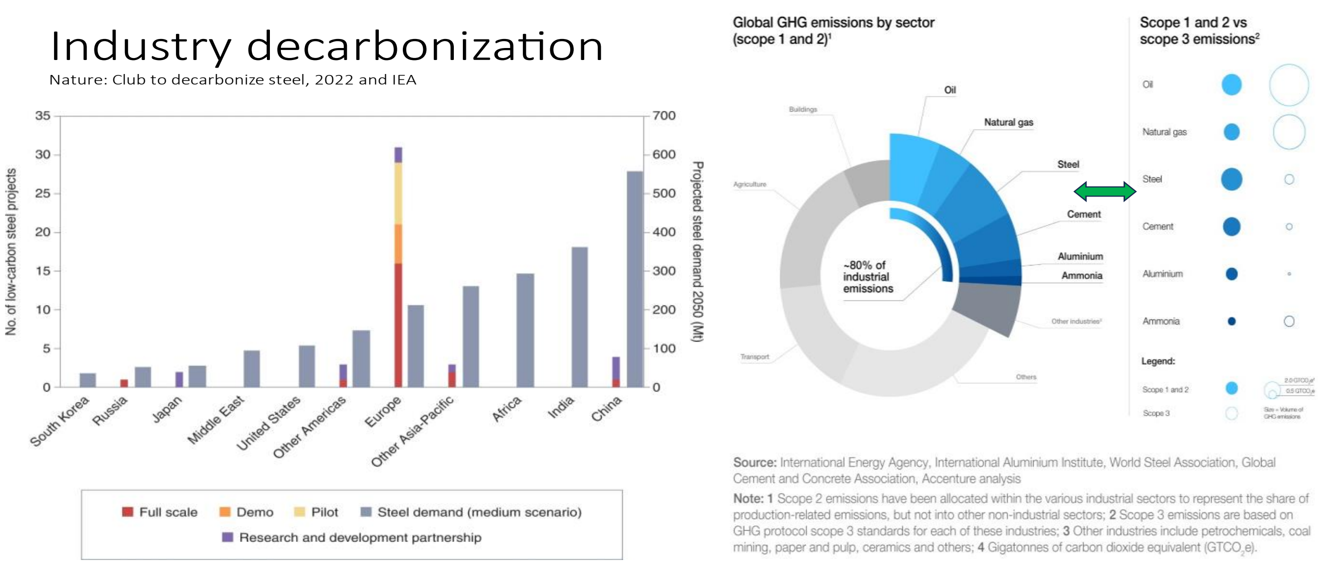


Fig. 5 Regional decarbonization projects

- Then there are issues of transportation – how do you get the hydrogen or clean ammonia to the steel mills and cement factories. Pipelines need to be repurposed with mix of hydrogen and gas so that heavy industry has access to cost competitive

Building political / economic support after COVID and Ukraine War is not an easy task for the Bundestag political coalitions. Various reports/policy commitments to a decarbonized economy indicate that that Germany understands the challenges and will try to fund the effort (billions per year). But how fast will demand build and how much will it cost? Other players / countries may not be so far sighted or have the necessary expertise. (*Fig. 6, Demand and cost technology* 8, 11)

Hydrogen EU markets, different strategies, policy & price, …costs

IPOL | Policy Department for Economic, Scientific and Quality of Life Policies

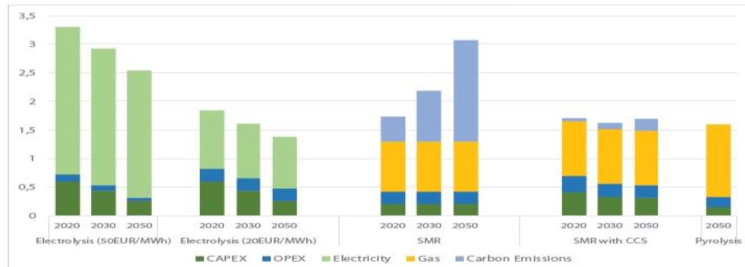
Table 5-1: Bottom-up estimations for potential hydrogen demand 2050 (TWh)

Probable Demand	Speculative Demand
Ammonia Production (100-250)	Shipping (0-320)
Methanol Production (20-30)	Aviation (10-170)
Steelmaking (70-260)	Heavy-duty trucks (10-220)
(Rural) Rail (1-5)	Industrial heat (0-70)
Seasonal Electricity Storage	Buildings (50-430)
Oil Refining (50-110)	Light Commercial Vehicles (0-60)
	Passenger Vehicles (10-140)

Source: Authors own elaboration.

The IEA ranks energy technologies based on their technological readiness level (TRL) ranging from 1 (initial idea) to 11 (predictable market growth reached)[89]. SMR with CCS is ranked as an 8 or 9. While SMR is very mature technology, the application of CCS requires developments to achieve commercial competitiveness. Depending on the type, the TRL of electrolysers ranges from 8 to 9. Finally, pyrolysis has a TRL of 6, a full prototype has been demonstrated at scale but there is still the need for commercial maturity to be proven.

Figure 5-3: Hydrogen Production Cost Decomposition (EUR/kg)



Question: which hydrogen production process will dominate by **2050 is as much political** as it is economic. Different European countries foresee very different futures,
- Germany focused on electrolysis hydrogen, while the Netherlands is open to future for natural gas-based hydrogen

The EC's hydrogen strategy is that while the future is in **electrolytic hydrogen**, **natural gas-based hydrogen** production will be required for a transition period.

Fig. 6 Demand and cost technology

Even if we have rationalized our hydrogen and climate policies across regions with most of the IPCC / COP participants (over 190 participating players/countries), we need significantly more investment moneys sooner rather than later – trillions over the next five years. We also operate in a multi-party, multi-polar world where some players and countries have very different expectations / capacities. Europe / Germany may move faster than North America / USA, while Mena producers pursue a different hydrogen development strategy. Markets and energy transitions will not equilibrate easily. And then there are the climate surprises that will probably require huge adaptive projects.

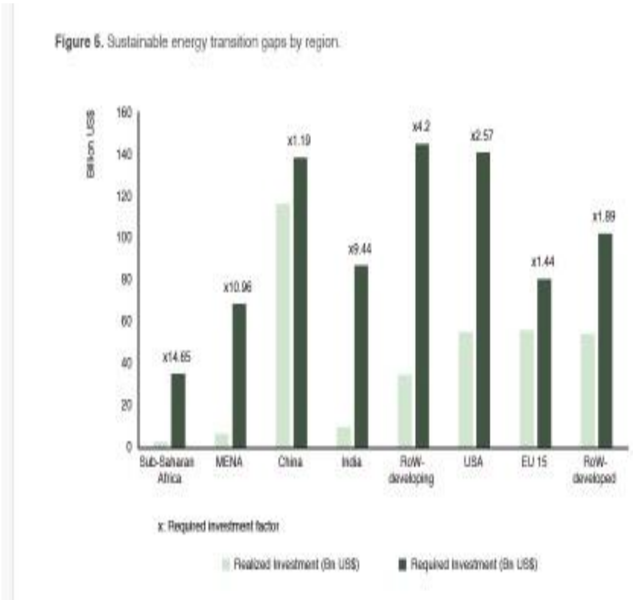
COP28, World Bank, IMF, and financial players recognize the massive shortfalls in capital markets (and competing needs), but some still believe / hope that the money will be there, particularly if it makes economic sense (*Fig 5 & 7*). However, hydrogen and many other clean energy technologies are in the early-middle stage / proof of concept launches -- the financial valley of death looms. The big joint ventures energy transition investments are not coming together fast enough.

How do we mobilize capital, bring together the information, and bridge the project investment expertise of private and public players? Much like the Marshal plan, Manhattan project, or World Bank we believe that a new quasi-public multi-party organization with laser like focus on developing clean energy supply /

2.7 Finance Gap:

<u>What is missing is the money</u>. How do we finance huge infrastructure, R & D, and product development / distribution of low-carbon fuels across different regional markets? Will markets / regions step up to the challenge, particularly with all the competing demands? The graphs (Fig 7) below show the huge financing gap by region (2-10 times current levels) for a sustainable electrical grid and hydrogen. Each region needs several trillion invested per year in their transition. (6, 11, 15) We know that early-stage finance for cleaner energy is reluctant to commit huge sums with so much demand / price uncertainty. We also recognize that there are long energy investment cycles depending on time horizons of the players with different costs, and market structure (i.e., NOCs longer term, IOCs more reactive to short term pressures, utilities need regulatory approvals), so investment appetite/returns vary greatly by player. And then, we have the challenge of who will bear the cost of a low-carbon transition without an equitable global carbon tax. Yes, some governments and consumers may be willing to pay more than others, but for how long? (see regional graphs, Fig 4)

decarbonized end markets is critical to a faster energy transition. And different regions have very different financial resources and capacities (*Fig. 7 Finance gaps*).



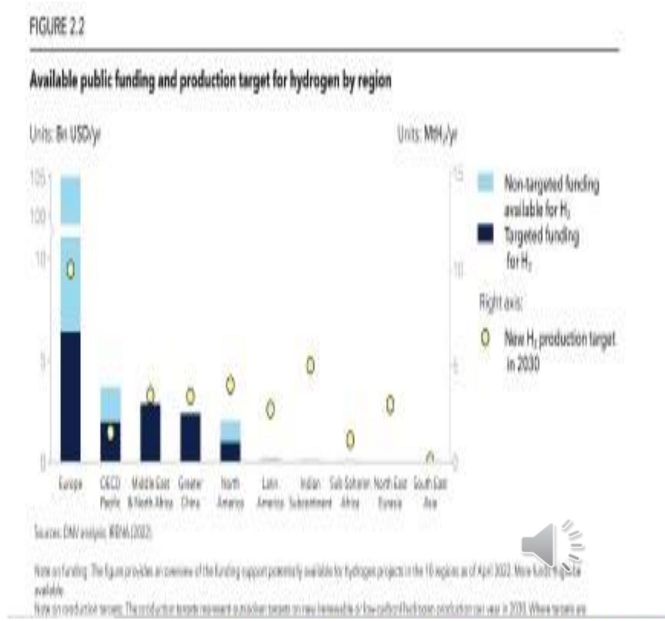


Fig. 7 Finance gaps

Risks must be managed IF we are to make the huge investments and manage priorities across countries.

2.8 Energy Bank: Assume for the moment that the estimate of $3-4 trillion Euros per year in clean hydrogen projects is a reasonable best guess. How do we mobilize x trillion of new moneys to cleaner energy sources within five years? In other words, $10-15 trillion in capital is directed toward the complete hydrogen supply chain so that the market is fully operational by 2035. (see 6, 8, 11, 13,15)

- Organizationally, we have many competing entities with different agendas that are not working together to fund rapid development of cleaner energies. Energy producers (IOC, NOCs) have different technical and production strategies, as do IPCC / sustainable advocates. Companies want to extract their rents while NGOs are concerned about the tragedy of the commons. And each government has varying transition strategies and political coalitions.
- How do we structure / manage a clean energy portfolio with different investor priorities and supplier needs. Again, competing perspectives on investments means that seed / early-stage funding attracts other moneys – joint venture players, banks, equity investors, and countries. An energy bank with a defined decision structure and real moneys (trillion) from participants helps fund projects through the development cycle. Building such a bank using other models / investors like the World Bank, OPEC and Sovereign Wealth fund is start.
- Flexibility, neutrality, and accountability. This is enormously difficult in a highly politicized world of climate and energy. Some areas / countries may choose higher cost green hydrogen / pipeline infrastructures while others move forward with shades of blue and carbon capture. The primary objective of an Energy Bank is developing / using cleaner energy sources quickly (e.g., Manhattan project). Again, the priorities / project allocation of regions differ greatly (Europe, MENA, Sub-Saharan Africa, Asia)
- Who leads and how do we go about fleshing out the structure and participants in regional Energy Banks. Certainly, the major energy producers and IPCC representatives, along with dominant capital market players, and energy consultants. Other models are out there, however it is also important to include key consumer regions / countries (ASIA, OECD, and USA) and largest producers (OPEC, USA, and maybe Russia). None of this is easy, so it may be more straight forward to start with regional energy banks rather than WTO / World Bank structure that

historically tend to be cumbersome and full of competing agendas.

The impetus for energy bank start with the dramatic changes in our energy / climate worlds. (*Fig 8 Energy Bank Goals*) The epistemology of Net Zero argues that we are not moving fast enough to bend our carbon curve by 2035. We must mobilize investment capital in late-early-stage projects (hydrogen, wind, batteries, small nuclear, waves) with expertise and a lot of money. This is not how our capital markets or energy producers are organized, so resistance to an evolving structure will be considerable. Some feel that the capital market / funding gaps for clean energy can be managed, or that we should work through existing structures that know the game. Others throw up their hands at the politics that divide our worlds as temperatures rise and weather surprises are insurmountable. And then, there are those who conjure up the big practical steps to address our complex energy challenges.

After 30 years of meetings, reports, and talk the players gathered at COP28 – producers, OPEC, IPCC, IEA, climate activists, consultants, journalists and concerned citizens heard the call to action. Much more money and capital investment is necessary. If we are lucky, we will stumble across the bumpy roads ahead to future possibilities.

3.O CONCLUSION

So how to move forward? Clean hydrogen has been highlighted as one of the critical paths forward. The technology challenges and funding gaps are identified, and the players know each other. Now, is time for leaders – with connections to moneys and technology and capacity – to come together with a firm agenda, realistic timetable, and specific goals to form a focused Energy / Hydrogen Bank. The EU has initiated its effort, COP28 highlighted the financing challenge, and almost everyone agrees that we must transition to a clean energy world faster. How we get there is not obvious. Survival of the fittest, Net Zero, Mountains, or Climate Tech?

Fig. 8 Energy Bank goals

We need to define the mission and goals of an energy bank, identify the players, and build a decision-making structure, so that x trillion of new moneys and project investments across regional markets are made by 2030 with the goal of y projects producing z tons of cleaner hydrogen by 2035. IF we don't our children and grandchildren will ask, "What did you do to make a better world?"

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