WORLD ENERGY COUNCIL

Innovation Insights Brief | 2019

ENERGY INFRASTRUCTURE

Affordability Enabler or Decarbonisation Constraint?

EXECUTIVE SUMMARY

Existing energy infrastructure has been built over many decades to support conventional energy uses including coal, nuclear, oil and natural gas. The rapid transition to a decarbonised energy system implies that some existing infrastructure will be either stranded or decommissioned early, therefore creating a need to assess and minimise the cost as well as mitigating the risk of cascading impacts. Consequently, the way we manage existing infrastructure will both affect and be affected by the chosen transition paths to decarbonisation. These choices determine the speed of decarbonisation and the affordability of the whole system transition. Existing infrastructure can play a big role, but there is a lack of coordinated vision of how infrastructure would fit into the broader energy transition agenda.

The World Energy Council has developed a set of **principles for designing an Infrastructure Action Plan** to ensure that decommissioning, stranded assets and/or repurposing does not become a barrier to affordable decarbonisation. These principles are based on deep-dive interviews with energy leaders from around the world, supplemented with research.

While the focus of this brief is existing infrastructure, a complimentary brief will be developed with the support and contribution of the global community, to plan for the new energy infrastructure associated with the growth and eventual dominance of new energies.

KEY FINDINGS

1. A successful energy transition depends on infrastructure that is adaptable, reliable and affordable. We need to find better ways to utilise existing energy assets as we transition to a decarbonised system
2. Use of existing infrastructure is a resource for more affordable transition to decarbonisation. Realising this opportunity must be a priority that requires consideration of infrastructure repurposing opportunities where these make sense.
3. The magnitude of stranded assets is unknown to the market. There is a potential risk that decarbonisation could become cost-prohibitive if large portions of existing infrastructure are stranded.
4. Businesses should reframe market strategies to explore the opportunities of reusing existing infrastructure to support transition to a low-carbon future.

RECOMMENDATIONS

1. EXISTING ENERGY INFRASTRUCTURE AND ITS POTENTIAL REPURPOSING OPPORTUNITIES SHOULD BE PART OF TODAY'S LONG-TERM PLANNING AND STRATEGIC DIALOGUE

Existing energy infrastructure has been built around conventional resources over many decades with trillions of dollars in investment. It will be a missed opportunity to not plan for the role of existing infrastructure in future energy systems.

2. NATIONAL GOVERNMENTS AND WIDER ENERGY STAKEHOLDERS SHOULD CO-DEVELOP AN ENERGY INFRASTRUCTURE ACTION PLAN

Energy leaders from around the world including national and regional policymakers have a critical role to play in driving forward the development of a coordinated Action Plan to better realise opportunities for aligning decarbonisation of energy supply with existing infrastructure that may need to be appropriately dealt with. In Europe, besides national governments, European policymakers will have a key role for energy infrastructure plan to ensure coherence for all the countries.

“USING EXISTING ASSETS, WHICH IS TYPICALLY LESS EXPENSIVE THAN BUILDING NEW ONES, ALLOWS TO MITIGATE COST, WHICH IS CRITICAL FOR BROAD SOCIETAL ACCEPTANCE OF THE TRANSITION.”

YURI FREEDMAN,
SR. DIRECTOR BUSINESS DEVELOPMENT,
SOUTHERN CALIFORNIA GAS COMPANY

“CERTAINLY, NATIONAL GOVERNMENTS AND MORE SPECIFICALLY GLOBAL BODIES CAN PLAY A ROLE IN SETTING A VISION FOR THE MANAGEMENT OF EXISTING ENERGY INFRASTRUCTURE; FAILURE TO DO SO COULD MAKE DECARBONISATION POLICIES COST PROHIBITIVE.”

AHMAD AL KHOWAITER,
CTO, SAUDI ARAMCO

THREE OPTIONS FOR EXISTING INFRASTRUCTURE:

DECOMMISSIONING

Returning a site to its original state prior to development, including removing structures, decontamination, and site restoration (e.g. shutdown of a power plant and subsequent site restoration).

OFF-SHORE OIL & GAS RIGS | ONSHORE OIL & GAS RIGS | POWER PLANTS

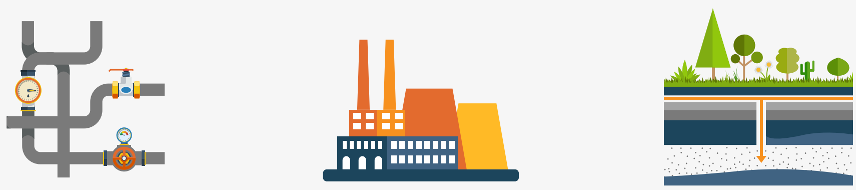
STRANDED ASSETS

Stranded assets are those that have suffered from unanticipated or premature write-downs, devaluation or conversion to liabilities (e.g. coal power plants that can be used but are no longer needed).

OFF-SHORE OIL & GAS RIGS | ONSHORE OIL & GAS RIGS | POWER PLANTS

REPURPOSING

The use of an asset for a purpose other than its original intended use (e.g. repurposing natural gas pipelines to transport other gases, such as hydrogen). For example:



NATURAL GAS PIPELINES | POWER PLANTS | OIL &GAS FIELDS

Decommissioning: Cost Estimates

- The 2018-2022 global forecasted decommissioning costs for offshore assets are about $32 billion.
- **North Sea** The decommissioning costs for 600 installations in the North Sea alone over the next 30 years could reach $65 billion.
- **Asia-Pacific Region** Approximately 2,600 platforms, 35,000 wells, 55,000 km of pipelines and 7.5 million tonnes of steel will have to be decommissioned in the Asia-Pacific region over the next decade with a potential cost of $102 billion.
- **Gulf of Mexico** Decommissioning costs for offshore production facilities, including 3,000 platforms, is forecasted to be $40 billion. These costs are subject to uncertainties and can increase considerably due to several factors that are discussed in this brief.

NOTE: Governments are in most cases responsible for a share of the costs of decommissioning in their region. For instance, the UK government is forecasted to burden 45% of the total UK decommissioning bill, while Norwegian government's share would amount to 78% of Norway's total costs.

Stranded Assets: Cost Estimates

Studies recently conducted on stranded assets vary a great deal on the forecasts of stranded assets. A source of uncertainty is the fact that predictions rely on possible scenarios that take into account variables such us climate targets and subsequent energy policies which may or may not be enforced. The figures referenced in this brief do, however, provide a measure of the possible proportions of stranded assets.

- The **global forecasted costs** of stranded assets across the upstream, power generation, industry and buildings could amount to $20 trillion over the next 30 years.
- The **upstream energy sector** could see between $1.8 trillion and $7 trillion in stranded assets.
- **Oil and gas** have already registered an estimated $ 1 trillion in stranded assets between 1997 and 2017.

Dealing effectively with existing infrastructure, whilst not inevitable, is not impossible. Two action plans offer innovative models for success.

1. NexStep, a joint initiative of EBN and the Dutch oil and gas industry, is the only holistic action plan developed in the world to date to deal with existing infrastructure.

2. California's *Action Plan*, although not directly dealing with infrastructure, offers an effective model of how to bring an industry together under a common vision. Both plans are featured as Figures 7 and 8.

In response, we propose key principles as a starting point for dialogue to create an Energy Infrastructure Action Plan ("EIAP") with shared goals and a flexible framework that can be adapted to the diversity of any region/country.

An EIAP is an instrument that aims to enable a more cost-effective and well-managed energy transition. As the energy mix continues to transition from the scarcity of fossil energy resources to an abundance of clean and renewable energy supply, existing infrastructure will experience decreasing levels of marginal return on investment.

California's Energy Action Plan

In 2003 California adopted a first of its kind Energy Action Plan ("EAP"). The EAP was in response to the energy crisis of 2000/2001 when the sixth largest economy in the world experienced electricity supply shortages as well as unprecedent natural gas prices leading to rolling blackouts costing the California economy billions of dollars. This plan was a set of shared goals and proposed specific actions to ensure that adequate, reliable, and reasonably priced electrical power and natural gas supplies were achieved and provided through policies, strategies, and actions that are cost-effective and environmentally sound.

The EAP proposed six sets of actions:

1. Optimise energy conservation and resource efficiency.
2. Accelerate the state's goal for renewable generation.
3. Ensure reliable, affordable electricity generation.
4. Upgrade and expand the electricity transmission and distribution infrastructure.
5. Promote customer and utility owned distributed generation.
6. Ensure reliable supply of reasonably priced natural gas.

This plan and ensuing loading order provided California with a roadmap of the actions necessary to ensure that the state met its energy needs going forward while controlling costs, maintaining leadership on energy efficiency, and renewable energy policies.

The loading order identified energy efficiency and demand response as the state's preferred means of meeting energy demand. After cost-effective efficiency and demand response, the state should rely on renewable sources of power and distributed generation, including combined heat and power applications. To the extent efficiency, demand response, renewable resources, and distributed generation are unable to satisfy increasing energy and capacity needs, clean and efficient fossil-fired generation is supported. Concurrently, the bulk electricity transmission grid and distribution facility infrastructure will be improved to support growing demand centres and the interconnection of new generation, both on the utility and customer side of the meter.

Although the EAP can be perceived as a logical step its significance lies in laying a solid foundation for the whole industry to use as either a vision statement or a policy platform. For California it provided the industry with a starting point and the fact that it was adopted by its regulators it also provided the market with an overall vision that gave needed guidance to the market to innovate and implement a clean and cost-effective energy industry. Today, California is a leader in clean energy generation, consumption and continued and aggressive policies for deep decarbonisation. One of the key success factors for California is the EAP that set the industry on a common path forward.

NEXSTEP

An example of best practice in introducing and implementing an industry-wide action plan to prioritise and address energy infrastructure decommissioning in a comprehensive and coordinated manner.

In the late 2016 Energie Beheer Nederland B.V, an entity wholly owned by the Dutch government and mandated to execute parts of the energy policy on behalf of the Ministry of Economic Affairs and Climate Policy released the **Netherlands master plan for decommissioning and reuse** – a result of the coordinated effort of the government, operators, suppliers, and other concerned stakeholders. The plan's key mission is "to ensure a safe, efficient and effective decommissioning of Dutch offshore infrastructure" with the focus on optimising costs while reusing and repurposing existing infrastructure where possible.

The document sets out a long-term vision for an integrated approach to decommissioning as well as a 20-year specific plan to optimise the decommissioning of approximately 150 offshore platforms and 1,800 active wells.

Delivering on the first priority of the Master plan on the October 10th, 2017 the Netherlands launchedNexStep– the world's first national platform mandated to encourage cooperation in the area of re-use and decommissioning of oil and gas infrastructure.

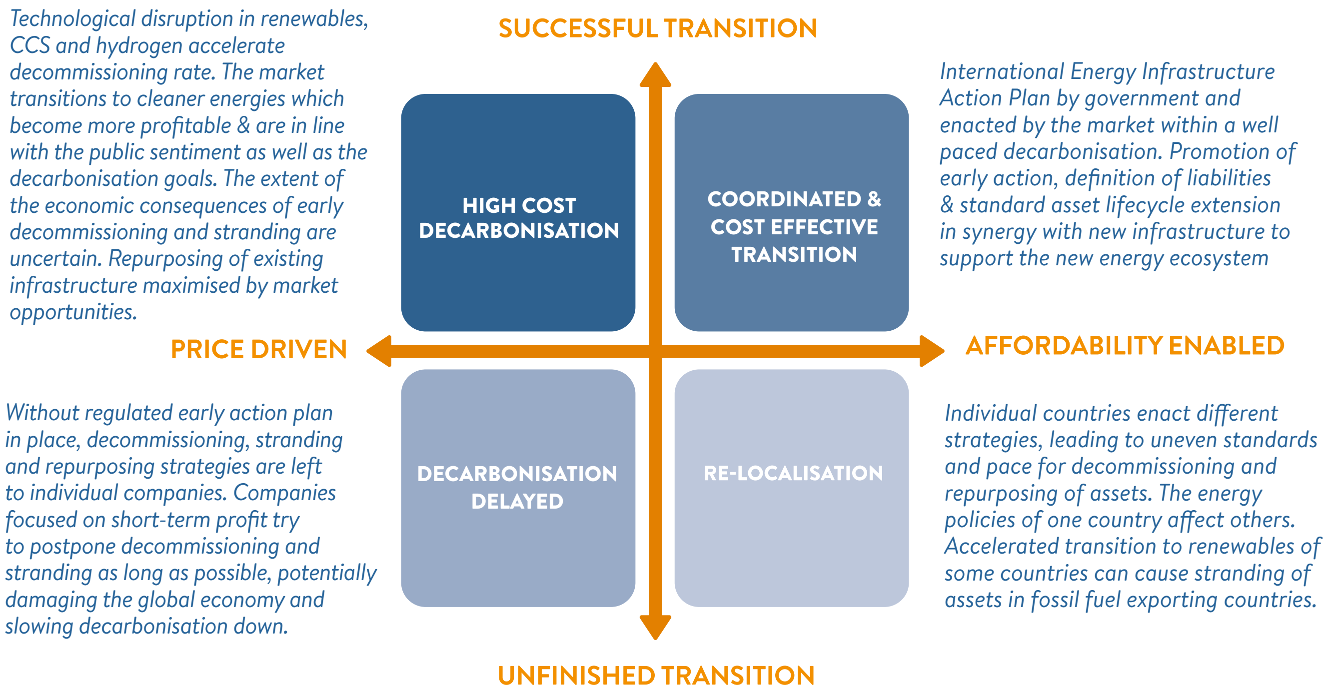
NexStep's mission is to serve as an inclusive and collaborative umbrella that coordinates, facilitates, and seeks dialogue on the re-use and decommissioning agenda for oil and gas infrastructure in the Netherlands. Although one of the goals of the organisation is to reduce the costs of safe and environmentally friendly decommissioning in the Netherlands by 30%, this is neither regulatory nor a financial institution. According to the legislation the financing and the removal of installations are the responsibility of the operators. NexStep's role is to connect diversified actors with different objectives, interests and agendas and encourage them to coordinate and collaborate with each other to achieve the most efficient and safe way to re-use or remove superfluous infrastructure.

Tasked to identify the oil and gas infrastructure that will be taken out of use in the next ten years, in 2018 NexStep presented the first issue of the annual "Re-use and decommissioning report" analysing decommissioning expected and required in 2018-2027. Importantly the key focus of the report is not just the assessment of the assets from the decommissioning perspective, but also the analysis of how re-use of infrastructure could contribute to the energy transition and how the existing infrastructure can serve the new energy system storage and transportation needs.

FUTURE OUTLOOK

When considered through the lens of a whole-system transition, existing energy infrastructure has two connotations: **1)** it can represent a resource for the transition. In this context, there is no opposition between old and new infrastructure but, rather, a synergistic conversation between the two. Part of the existing infrastructure can facilitate the transition by supporting the energy mix assuring energy security and by providing assets that can be used by clean energy sources, **2)** part of the existing infrastructure will have no purpose in the new energy ecosystem, and this represents a hindrance to the transition if not dealt with in time, by slowing down the adoption of clean energy sources as well as unnecessarily burdening the economy by delaying its decommissioning or increasing the extent of stranding.

The transition to a new energy future cannot be predicted but it can be better prepared for using scenarios. Four scenarios are provided, each reflecting a plausible but different infrastructure transition pathway. Combined with a long-term shared vision it is possible to catalyse and guide an integrated approach to decommissioning, repurposing, life-cycle extension while minimising the risk of stranded assets.



NEXT STEPS

While the focus of this brief has been on existing energy infrastructure, the Energy Infrastructure Action Plan is intended to be a living and flexible framework. We chose not to include new energy infrastructures at this point to ensure existing infrastructure was not an afterthought. Due to its scope, breadth and importance, however, we plan to focus on new infrastructure in a separate brief, with the aim of addressing the following questions and further enriching the EIAP framework.

1. What will be the impact of new infrastructure on the pace and cost of decarbonisation?
2. What will the infrastructure look like within the new energy ecosystem and how will it serve it and the people of the planet?
3. How can the existing infrastructure be integrated with the development and deployment of new infrastructure to promote a virtuous transition?
4. Is the existing energy infrastructure system too constrained and can its design be successfully reassessed in a rapid, secure, just and sustainable way?
5. Can new technologies, such as the rise of digitalisation, automation and AI, help the infrastructure transition and how?