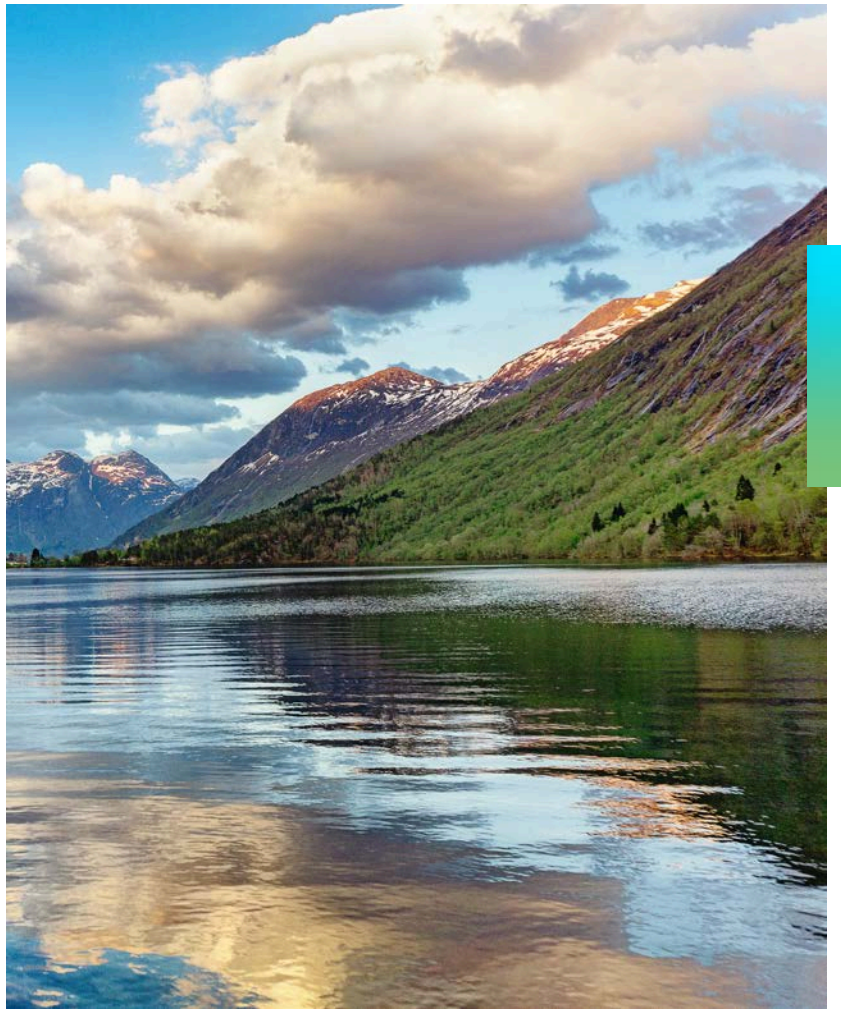
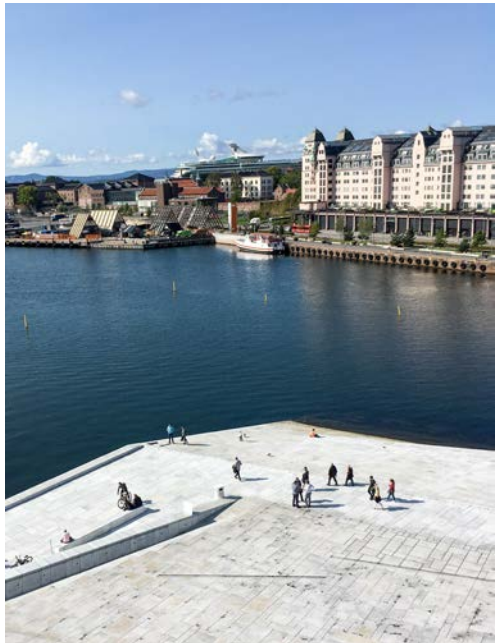
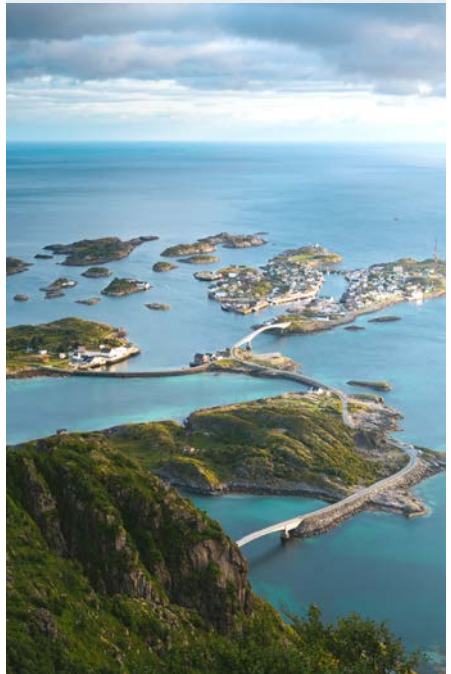
NHO + BCG BOSTON CONSULTING GROUP



Norway's competitiveness in the energy transition



JANUARY 2021



Setting the scene

We have established a quantitative ranking to indicate Norway's competitive position in the energy transition

Rapid assessment based on established frameworks

BCG has conducted rapid study with NHO that aims to quantitatively rank selected countries' competitive position in the energy transition, building on existing frameworks from World Economic Forum (WEF) and the European Union (EU)

Quantitative ranking and qualitative assessment of competitiveness

The purpose of the 'temperature gauge' and qualitative assessment is to identify and measure sources of competitiveness as a host nation for growth related to the energy transition, focusing on technology domains with export potential. We seek to identify patterns of what the nations that succeed do well and where the rest can improve

Interviews with leading companies in Norway's energy transition

The 'temperature gauge' and qualitative assessment is complemented by interviews with leading companies in Norway in order to identify opportunities for growth in the energy transition, as well as requirements to succeed with the growth to create jobs and export opportunities

Source: BCG-NHO study of Norway's competitiveness in the energy transition

Temperature gauge of Norway's competitive position in the green transition builds on a transparent framework

Norway's competitive position

Framework builds on WEFs[1] and EUs[2] frameworks - adjusted to the purpose of the green transition

Dimension	Description
Human capital	Access to relevant competencies, labor, and supply chain
Market & capital	General market conditions and access to capital and demand market
Policy framework & incentives	Political facilitation of legislation, support schemes and priorities
Natural resources & infrastructure	Local resource availability and access to relevant infrastructure
Technology & innovation	Access to relevant tech, R&D investments and pace of innovation

1. World Economic Forum: Global Competitiveness Index, Sustainable Competitiveness Index 2. EU Regional Competitiveness Index
Source: BCG-NHO study of Norway's competitiveness in the energy transition

Relevant indicators identified for each dimension in the framework

Dimension

Human capital	Market & capital	Policy framework & incentives	Natural resources & infrastructure	Technology & innovation
• PISA Math and Science score • Science/Technology graduates • Employees in energy and green tech. companies[1] • Research publications • Skilled working immigrants	• Ease of doing business • Labor cost • Company tax-rate • State of cluster development • VC[2] investments • Investments in renewable capacity • Size of relevant end markets	• Institutional trust • Regulatory stability • Environmentally related taxes, incl. CO_2 pricing • CO_2 reduction target • Subsidies (RES[3], Bioenergy, Hydrogen) • Green stimulus as part of COVID recovery • Financial support schemes renewables • Support schemes transportation and heating/cooling	• Capacity of relevant resources; natural gas, wind, solar, hydropower • Share of electricity from renewable energy • Growth in renewable share of electricity • Electricity capacity surplus (export) from renewable sources • Transport infrastructure • Electricity infrastructure	• Environmentally related public and private R&D spend • Environmentally related patents • Global digital competitiveness ranking • Labor productivity

Indicators

1. Leveraging NACE (Statistical Classification of Economic Activities in the European Community) 2. Venture Capital 3. Renewable Energy Systems
Source: BCG-NHO study of Norway's competitiveness in the energy transition

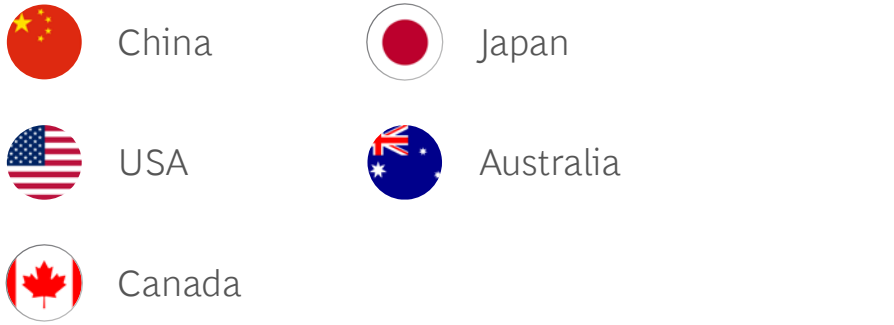
Norway's competitive position evaluated in a "European championship", then further compared to selected global peers

Temperature gauge of Norway's European competitiveness

10 European peers serve as benchmark to assess Norway's competitiveness in the energy transition

Temperature gauge of Europe's competitiveness in the world

Selected global peers relevant to assess performance of Europe in a global context[1]

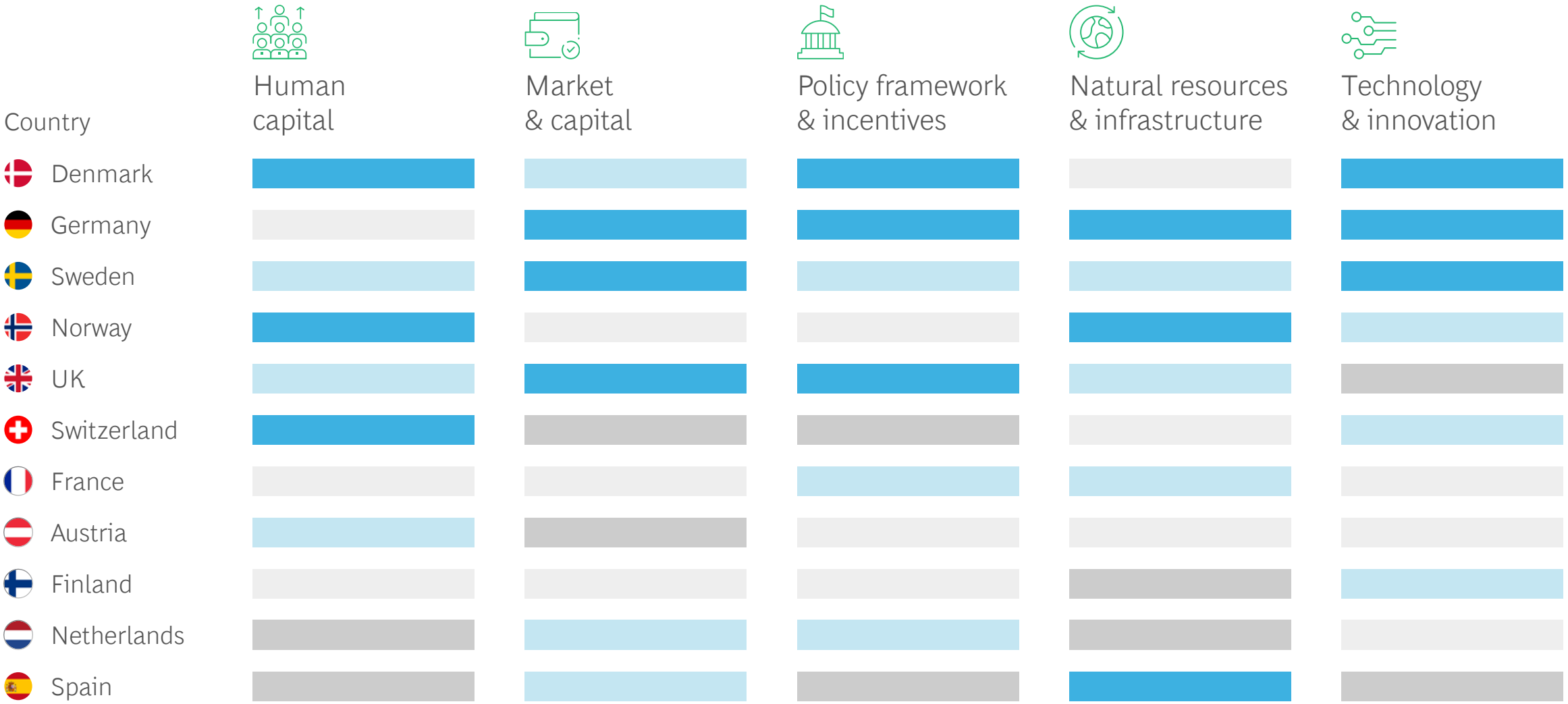


1. Initial quantitative assessment of global peers using same framework as for European temperature gauge
Note: Peer European countries selected based on top quartile of Environmental Performance Index (EPI) ranking. Luxembourg excluded based on size. Global peers selected based on size of economy, population and EPI ranking
Source: Environmental Performance Index 2020; BCG-NHO study of Norway's competitiveness in the energy transition

Denmark with highest competitiveness score in Europe; Norway just outside the podium

Source: BCG-NHO study of Norway's competitiveness in the energy transition

Top scoring European nations with strengths across dimensions



Source: BCG-NHO study of Norway's competitiveness in the energy transition

Norway has a solid starting point…

Norway with strong fundamentals

- Highly skilled future energy workforce with high share of tech students in universities and a large petroleum sector
- Solid market foundations with stable system, reasonable tax levels and a sizable industry sector which may serve as home market
- CO_2 reduction targets in line with those of EU, key policies and support schemes in place
- Substantial access to natural resources such as hydropower and natural gas, in addition to well-established transport and electricity infrastructure
- Solid level of R&D efforts and high readiness to adopt and explore digital technologies

Source: BCG-NHO study of Norway's competitiveness in the energy transition

… but we can learn from the best in order to further boost green competitiveness

Winners are able to connect strengths in a holistic and long-term strategy

Characteristics of winning nations:

- Holistic and long-term strategy, combining strengths from all five dimensions
- Consistent communication of ambition and strategy to all stakeholders
- Partnerships across government and business community
- Accountability for progress

Source: BCG-NHO study of Norway's competitiveness in the energy transition

Norway can advance position in the new energy economy

- Norway has strong fundamentals with an advantage in access to natural resources and human capital
- Looking at the winners, we see potential for Norway to improve competitiveness by setting a clear direction for the energy transition, defining a holistic strategy connecting all strengths, and partnering across government and businesses

Denmark able to combine strengths in a holistic approach

Relevant learnings from Denmark

Ambitious target and communication of consistent direction

- Target of 70% CO_2 reduction clearly and consistently communicated, with focus on long-term competitiveness, wealth and job creation
- Target codified in law and Minister of Climate and Energy held accountable

Partnerships across government and business community

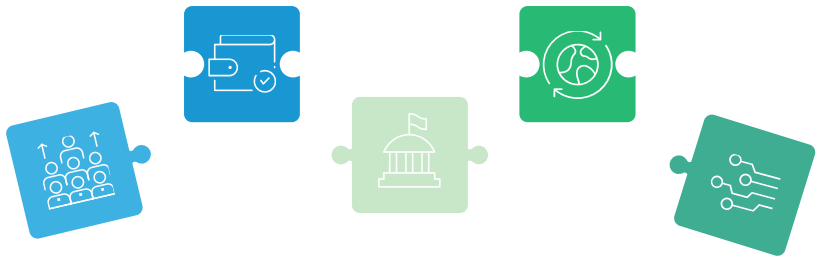
- Partnerships established by government with representatives across the business community to ensure alignment and progress on green priorities
- Responsibility delegated from government to business community; tasked with identifying relevant measures, prioritizing, and defining policy and support needs

Holistic and long-term view of priority areas

- Government with long-term and consistent focus on developing wind power and increasing country's energy efficiency (30+ years)
- Significant subsidies allocated to early phase of long-term profitable plans
- Initiatives targeting all relevant stakeholders; suppliers, consumers and stimulation of new business
- Investments in fundamentals to strengthen competitiveness within priority areas, e.g. investments in new university courses on wind technology

Source: Dansk Energi; Erhvervsministeriet; State of Green

Norway needs to connect strengths and set clear direction to succeed



Strong fundamentals serve as a solid basis…

Strong overall score, combined with an advantage in access to natural resources and human capital, serve as a solid foundation for the energy transition and is necessary to compete with the top nations in Europe and globally.

However, a strong foundation alone is not sufficient to create a sustainable competitive advantage.

Source: BCG-NHO study of Norway's competitiveness in the energy transition

…but we need to connect our strengths across dimensions and set direction

Norway has been an energy nation for decades with a strong position in oil & gas and hydropower. If we are to continue this energy journey in the future, we need to adapt and think differently in order to succeed with the green energy transition.

There is a clear sense of urgency, as other nations are now creating significant momentum. Norwegian businesses are ready, but there is a lack of a holistic and united approach across private and public sectors in order to focus on the right opportunities.

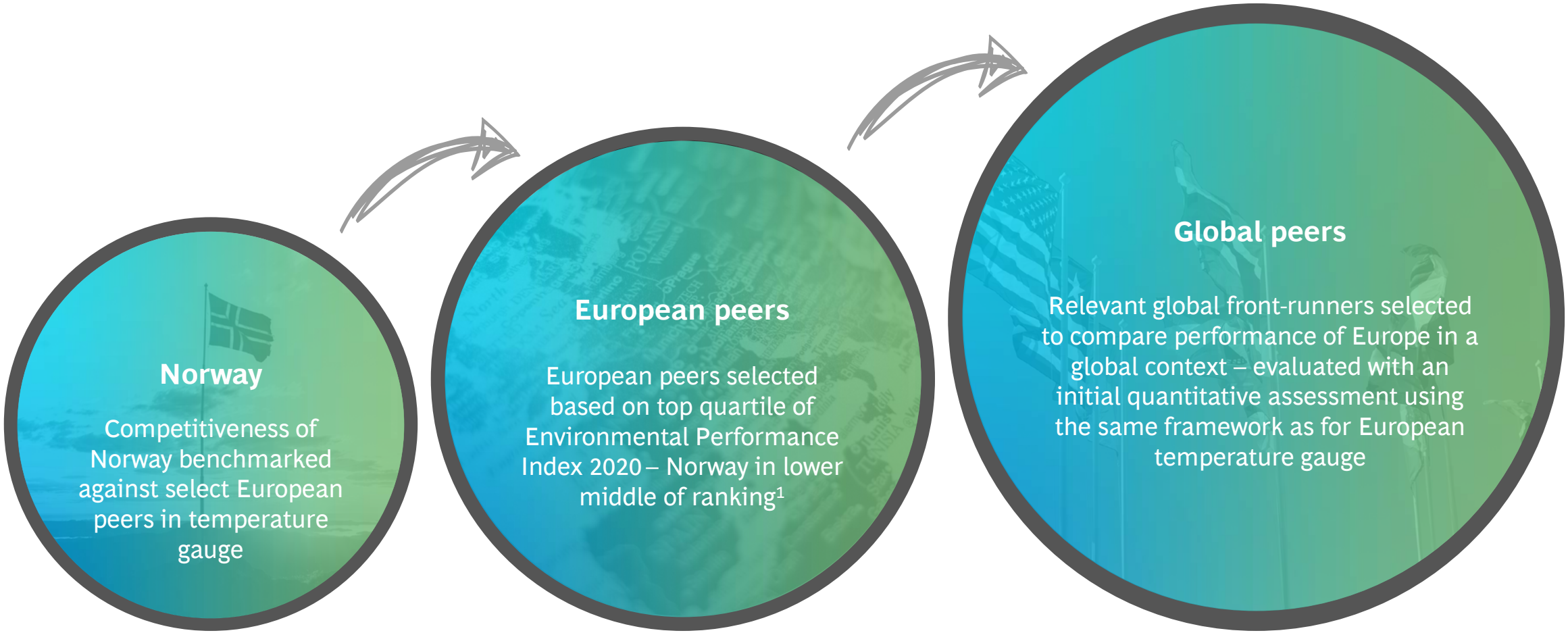
Norway needs to set out a clear and consistent direction for the energy transition, create a holistic strategy connecting strengths across all dimensions, partner across public and private sectors, and ensure accountability for progress. This is a transformation, where the solution cannot be found in one single company or one single institution. Only by joining forces – across disciplines and traditional boundaries – can we continue to create export opportunities, wealth and jobs in the renewable energy sector.

Deep dive

Global peers & technology domains

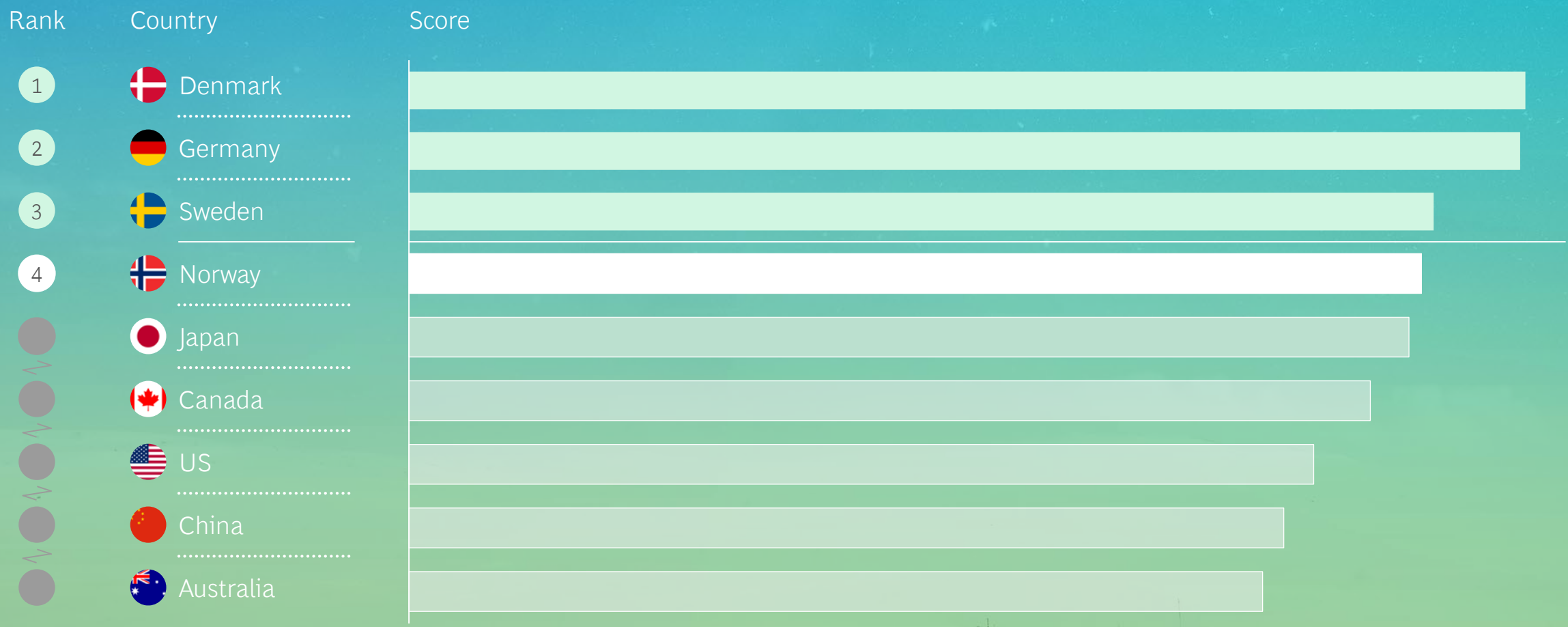
Source: BCG-NHO study of Norway's competitiveness in the energy transition

Global peers | Temperature gauge ranks Norway vs. European peers, while global assessment compares Europe to global front-runners



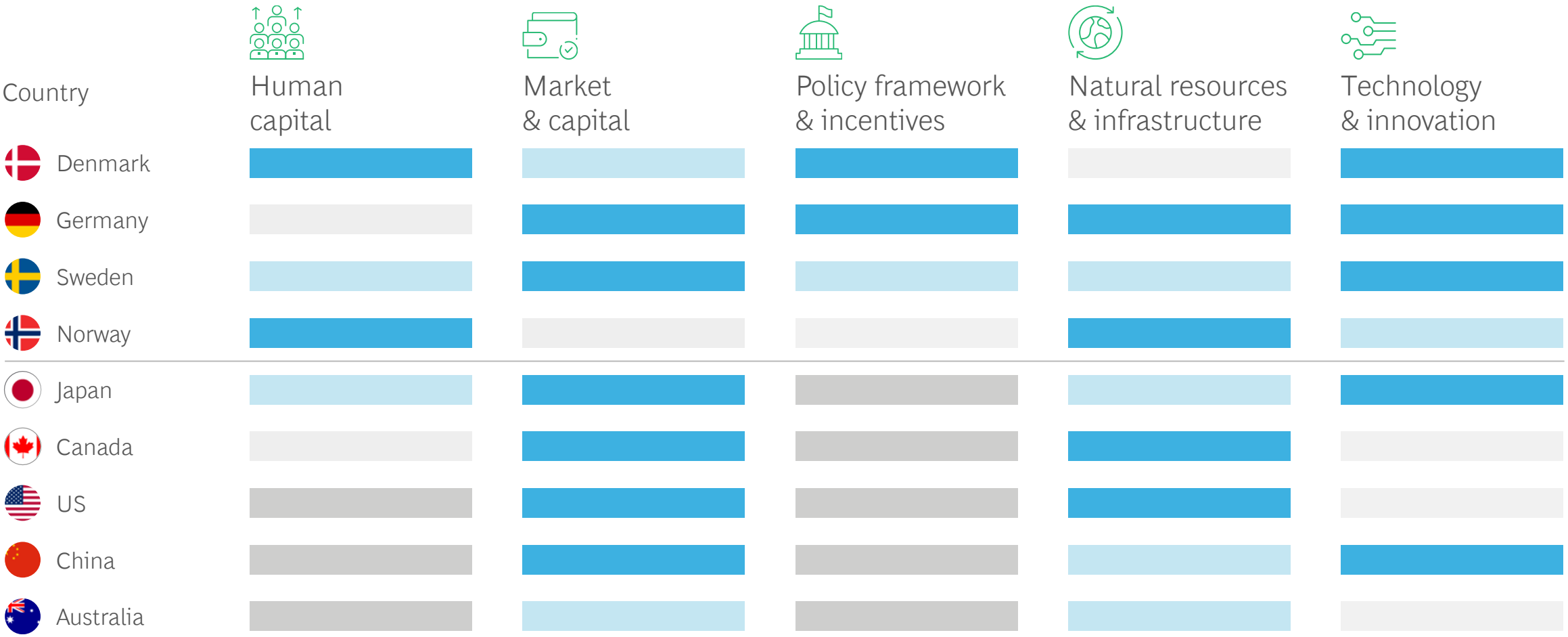
1. Norway ranked 8th in EPI ranking with three of selected peers on lower ranks. The index measures how close countries are to established environmental policy targets and is thus not directly comparable to the temperature gauge
Source: BCG-NHO study of Norway's competitiveness in the energy transition

Selected global peers score behind Norway on sum of fundamental dimensions – Japan closest to the European podium



Source: BCG-NHO study of Norway's competitiveness in the energy transition

Selected global peers are strong in market and natural resources, but lagging on policy framework and human capital



Note: Quartiles based on European peer group
Source: BCG-NHO study of Norway's competitiveness in the energy transition

Top quartile | Above median | Below median | Bottom quartile

Technology domains | Ten domains cover all green growth areas – six domains prioritized in analysis for Norway

Large-scale renewables
Expansion of current renewable activities, as well as adoption of new production methods

E.g. hydropower, on- and offshore wind power, solar, geothermal

CCUS (Carbon capture, utilization & storage)
Capturing CO_2 from stationary emitters and transporting it for storage or utilization

Example utilization: Fabrics, plastics, concrete, biofuel, etc.

Power system optimization
New technology to optimize balance between demand and supply to avoid expansion of grid network

E.g. demand flexibility, B2B/B2C energy systems, etc.

Hydrogen-related energy sources
Production, distribution or consumption of hydrogen as an energy source or input factor

E.g. small- & large-scale hydrogen production, ammonia, etc.

Energy storage
Technologies, methods and business models for storage of large amounts of energy

E.g. centralized battery storage, pumped hydropower

Electricity based transportation
Charging services and infrastructure, as well as new business concepts and platforms, including Power to X

E.g. charging infrastructure, fleet charging, car pooling, etc.

Small-scale/distributed renewables
Installation, operation, distribution and development of business models and platforms for small scale resources

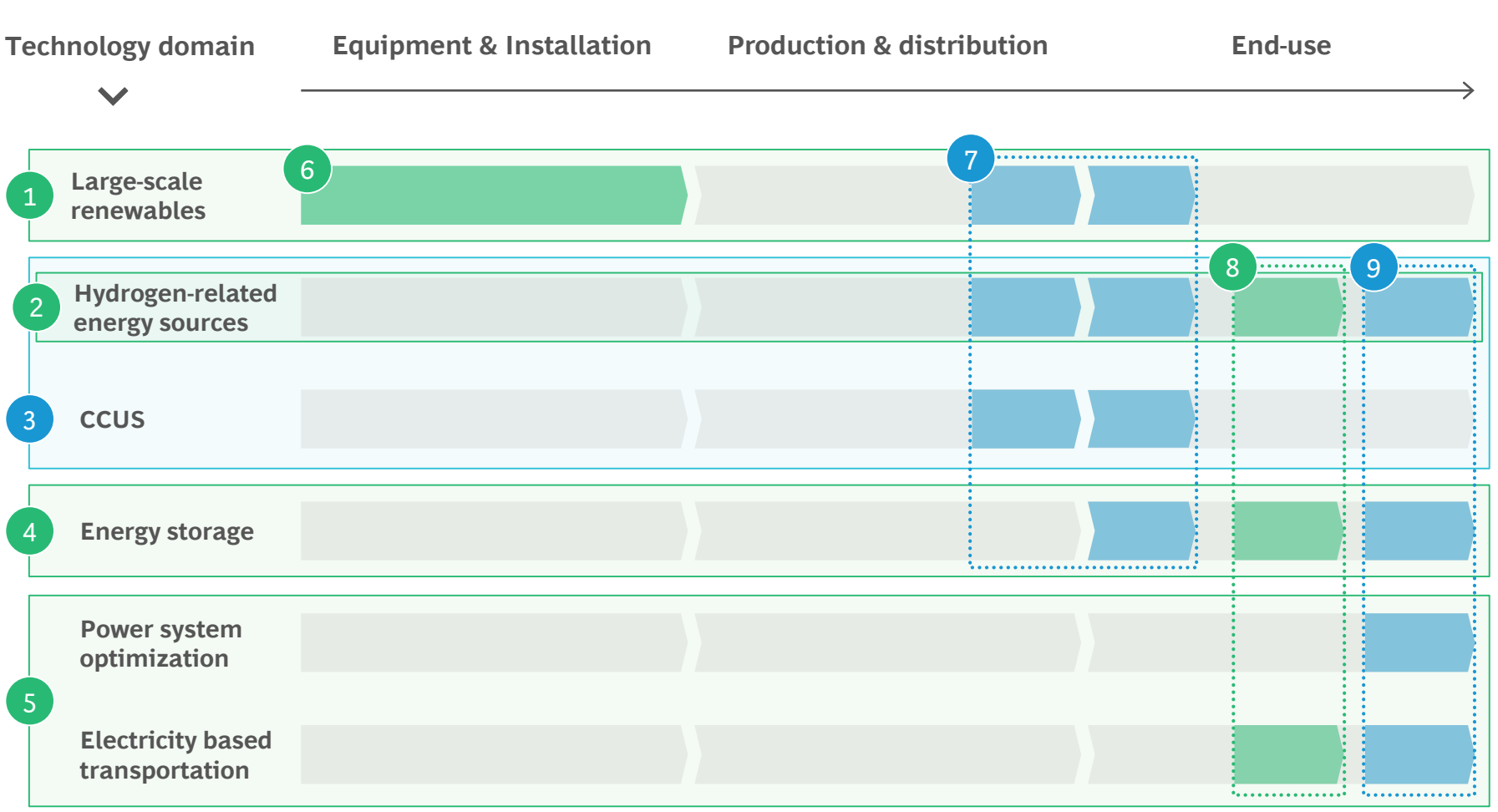
Heat generation
Production and distribution of heat, as well as energy sources or systems for heat production

Biobased energy sources
Production and distribution of emerging or unconventional sources of energy

Energy efficiency
Methods of reducing energy consumption by using less energy to attain the same amount of useful output

Source: BCG-NHO study of Norway's competitiveness in the energy transition

Relevant ecosystems span across technology domains' value chains



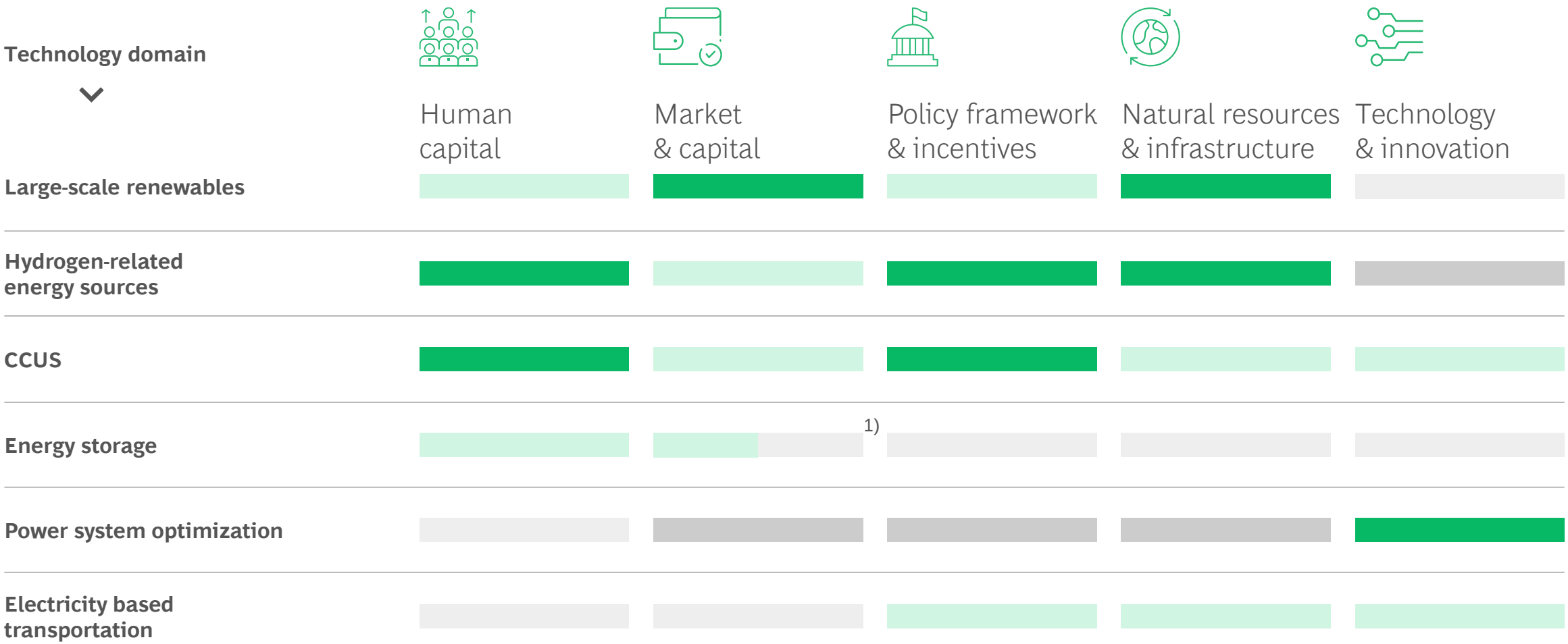
Relevant value chains and ecosystems

1. Global renewable players
2. Hydrogen
3. Blue hydrogen + CCUS
4. Batteries
5. Power system optimization and smart road charging
6. Offshore wind supply chain
7. Industry sector
8. Maritime sector
   GEV[1] also includes ship building
9. Transportation sector

1. "Grønne Elektriske Verdikjeder"
Source: "Grønne Elektriske Verdikjeder" (2020); BCG-NHO study of Norway's competitiveness in the energy transition

Covered in GEV[1] report Not covered in GEV[1]

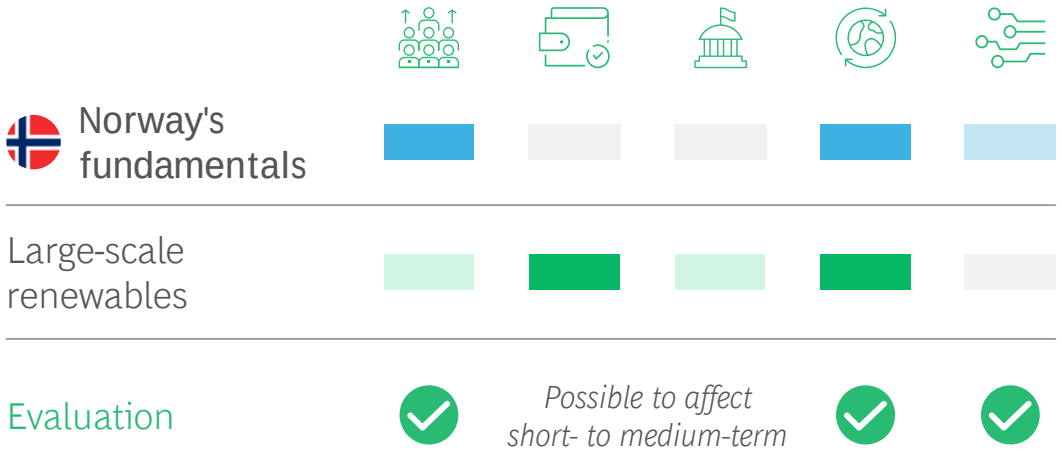
Different strengths are important across technology domains



1. Large variance within technology domain
Source: BCG-NHO study of Norway's competitiveness in the energy transition

Example[1] | Large-scale renewables is one example of a potentially attractive technology domain for Norway

Norway's strengths are a good match for large-scale renewables



Our strong human capital and legacy industry positions provide a good starting point for large-scale renewables

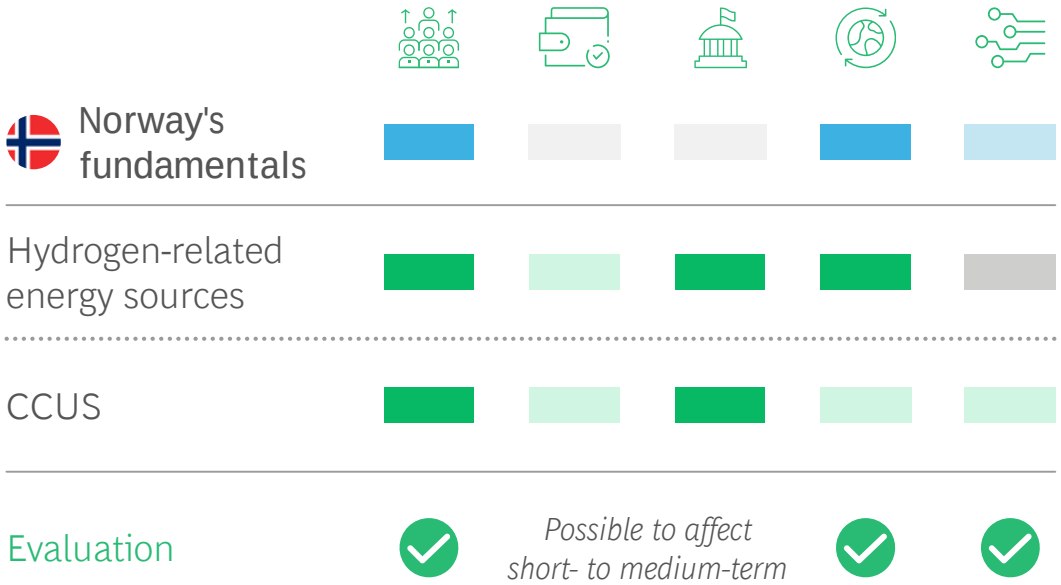
- Norway has a unique human capital starting point in the energy sector, especially in LCPM[2] domain
- Going forward, a likely surplus of highly skilled O&G workers can be utilized effectively in the energy transition
- There are several applications for clean power from LSR[3], e.g. in export-oriented ecosystem of green steel production
- Norway has a developed infrastructure (e.g. cutting-edge shipyards) that provides an advantage when developing LSR[3]
- In addition, future industrial and societal power demand may result in a need to develop new renewable capacity to maintain Norway's green energy surplus

Strength of dimension relative to peer group	Top quartile	Above median	Below median	Bottom quartile
Importance of dimension in technology domain	High	High - Medium	Medium - Low	Low

1. Example of how to apply the temperature gauge for evaluation of technology domains 2. Large Capital Project Management 3. Large-scale renewables
Source: SINTEF; BCG-NHO study of Norway's competitiveness in the energy transition

Example[1] | Green/ blue hydrogen and CCUS are other examples of potentially attractive technology domains for Norway

Norway's strengths are a good match for green/blue hydrogen and CCUS



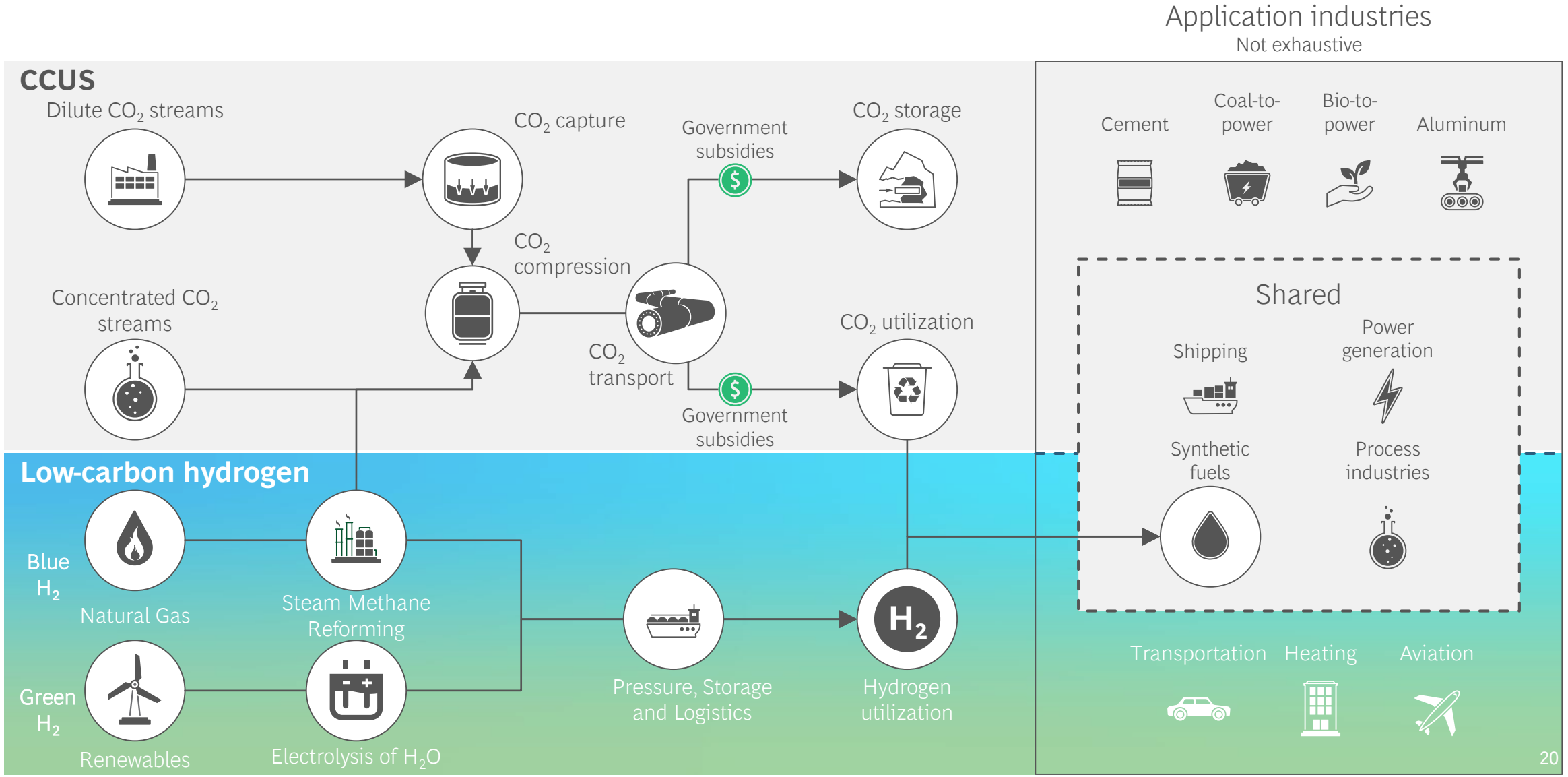
CCUS can open the door for blue hydrogen while green hydrogen is attractive given Norway's clean hydropower

- CCUS is necessary to achieve Paris agreement ambition; an estimated ~14% of total reduction should come from CCUS
- CCUS is currently the only way to decarbonize some of the world's critical industries (e.g. cement and metal production)
- With access to efficient CCUS technology Norway can utilize large natural gas reserves to produce blue hydrogen
- There are clear downstream synergies combining blue hydrogen and green hydrogen utilizing Norway's clean hydropower
- The resulting ecosystem represents an opportunity to decarbonize important industries, e.g. fertilizer production

Strength of dimension relative to peer group	Top quartile	Above median	Below median	Bottom quartile
Importance of dimension in technology domain	High	High - Medium	Medium - Low	Low

1. Example of how to apply the temperature gauge for evaluation of technology domains 2. Large Capital Project Management 3. Large-scale renewables
Source: SINTEF; BCG-NHO study of Norway's competitiveness in the energy transition

Illustration of CCUS and hydrogen ecosystems and applications



Source: BCG-NHO study of Norway's competitiveness in the energy transition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