

# ESTABLISHING A GREEN INVESTMENT BANK

*Climate finance for green competitiveness*

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# ACKNOWLEDGEMENTS

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# KEY MESSAGES

## Recommended scenario

We recommend to establish a Norwegian Green Investment Bank that realizes high-potential innovations internationally. Its mandate is intended to spark and facilitate promising innovations and to scale up proven technological solutions. The approach is to maximize the attraction of private capital and mitigate risks for sustainability investments. Even though the affiliation may be Norwegian, the GIB is recommended to initiate strong Nordic collaboration through partnerships on a city, company and project level.

## Communication toolbox

The GIB is recommended to use state of the art initiatives for implementation of ESG factors in investment decisions. The following toolbox could be helpful:

- The Statement of Significant Audiences and Materiality
- Sustainability Accounting Standards Board (SASB)
- Sustainable Value Matrix
- Integrated Reporting
- Climate-related Financial Disclosures framework, to be launched by the end of 2016
- CICERO's frameworks on climate-related investments in developing countries and climate adaption, to be launched by the end of 2016

The GIB could also consider using sustainability initiatives like UN Global Compact, UN PRI, CDP, the Equator Principles and GRI to be present in more established initiatives.

## Sectors

The GIB is recommended to prioritize three strategic focus areas:

1. Zero emission transport
2. The transition of the petroleum sector
3. Clean production technologies

To meet these strategic areas, the GIB can invest in multi-target focus areas, for instance:

- Battery technology and energy storage
- Electrification of the process industry
- Distributed energy systems



**PART 1**

**INTRODUCTION**

## REPORT TO THE EXPERT COMMITTEE ON GREEN COMPETITIVENESS

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This report is intended as a support document for the government's expert committee for green competitiveness, led by Idar Kreutzer and Connie Hedegaard. The committee will deliver a strategy to the Norwegian government in October 2016 to meet the barriers, challenges and opportunities for industry on the path to a low emission society. Sectors with the highest potential to create innovations for green competitiveness in Norway on the pathway to 2030 and 2050 will be prioritized. This report will outline a strategy on how the establishment of a Green Investment Bank (GIB) can amplify the efforts to create green competitiveness in Norwegian industry.

## ESTABLISHING A GREEN INVESTMENT BANK

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In recent years, a number of Green Investment Banks have been established globally to mobilize private investments into green technologies and businesses. These banks are publicly initiated entities that use public capital to facilitate private investments into low-carbon, climate-resilient (LCR) infrastructure. Investments made by the GIBs are made through innovative transaction structures, risk-reduction evaluation and management methods and sound market expertise. While GIBs vary in name, size and approach, they usually have a specific and limited mandate to fund cost-effective sustainability solutions. The performance of the invested funds is often measured by non-financial metrics focused on emissions reductions, job creation, leverage ratios (i.e. private investment mobilized per unit of public spending) as well as rate of return as a traditional financial metric. Through their specified mandate and governmental affiliation, GIBs can create attractive opportunities for institutional investors. They have set examples of best practice in their operations in terms of including ESG evaluation in asset management and external sustainability communication.

### THE EXPERT COMMITTEE WILL ADDRESS THE FOLLOWING QUESTIONS:

#### **Regulatory framework**

What are the most important global and regional processes that drive or create barriers for the transition towards a low emission society?

#### **Consequences**

Which challenges and opportunities will the transition impose on Norwegian businesses, and which sectors within society and industry will be most affected?

#### **Competitive advantage**

Where does Norway have the best prerequisites and what are the biggest challenges related to the transition?

#### **Priorities**

What should be the overarching priorities and means to develop innovation and green competitiveness for Norway?

## IMPLICATIONS OF THE MASTER THESIS

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The report is based on key takeaways from the Master's thesis titled "Financing the transition to a green economy: an empirical investigation of how firms can achieve business models for sustainability" submitted in June 2016. Some of the main implications drawn from the thesis are further elaborated in this report. One of the main findings from the empirical investigation was the need for additional capital to address gaps in the current public funding system and the private capital market. Secondly, business and financiers have a common responsibility to integrate sustainability into the core of their business model. This entails the adoption of a long-term view, and changes to existing practices of economic value capture and financial evaluation methods. More specifically, improved sustainability communication and novel use of financial instruments need to be implemented to overcome market barriers that currently prevent innovation of more sustainable business models. Finally, the thesis unveiled what underpins the mandate of the expert committee: the objective of industry development should be the key driver for investments made by the GIB. Several industry sectors have been identified as multi-target areas for investments, and have potential for value creation from an industry, energy and climate policy perspective. In addition to data from the empirical analysis, recent public accounts and documents, annual reports and industry insights on the topic have been sourced to complement and validate the findings. Combined, these sources serve as a foundation to outline implications of how a green investment bank can finance the green transition of Norwegian industry.

## STRUCTURE OF THE REPORT

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The report is divided into five parts. Following this introductory chapter, the second part will give a brief overview of current policies and ongoing political processes. Reflections on the identified gap for investments in the public funding system is then offered together with relevant sectors for investments. Part three will introduce the role of Green Investment Banks globally, and discuss key considerations for establishing a GIB in a Norwegian context. Following this, part four introduces three scenarios that outline alternative configurations for the GIBs. Lastly, a final recommendation will be made with implications for both industry and policy makers.



# CURRENT POLICY AND PRACTICE

PART 2



## ONGOING POLITICAL PROCESSES

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The transition of Norwegian industry and business requires changes in public policies, funding schemes and management practices. The government has initiated a number of processes to map the state of current political systems, market conditions and the need for new initiatives. One of these processes is the work of the Expert Committee for Green Competitiveness. Other processes are set to evaluate the efficiency and effectiveness of the public funding agencies and corresponding needs to expand or change the current mandates. In addition, there is a new law for public procurement and the release of several public documents that are relevant for the green transition: *Industrimeldingen*, *Energimeldingen*, *Bioøkonomi-meldingen*, *Grønt skatteski* and *Perspektivmeldingen 2017*. One process of particular interest is the decision to set up a fund for investments in green technology, a fund that shares similar objectives and features with a new GIB. Key facts of Fornybar AS is presented in Spotlight 1. With the many mentioned processes in the pipeline, there is no time to waste. Fulfillment of UN's Sustainable Development Goals (SDGs) and the Paris Agreement are urgent matters which call for decision-making that can be turned into action as soon as possible.

### INDUSTRY AND ENERGY POLICY - A TALE OF STRONG COMPANIONSHIP

Historically, key political events in the development of Norwegian industry have been driven by unified objectives with energy policy. The industrialization processes of the maritime, petroleum and process industry have been founded on the need for access to clean and cost effective energy to enhance a competitive industry. Today, the access to hydropower has given Norway an abundance of cheap and clean power. The rationale for new investments in infrastructure and new energy solutions is thus largely found in the need for industrial development over energy policy, which sharply contrasts the situation of most other countries. Representing a broad range of stakeholders, our findings show that a new Green Investment Bank should promote industry policy through its investment areas and priorities. This can be done by increasingly looking to unify industry and energy policy in the areas of green technologies.



## SPOTLIGHT: Fornybar AS

*The Norwegian Government is to establish a new fund intended to co-invest with private actors in green technology. The mandate, organizational structure and budget will be made public in 2016.*

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### Key facts:

Fund name: Fornybar AS (Greenfund)

Total assets: 20 billion NOK

Location: TBD



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### Can Fornybar AS be Norway's new green investment bank?

In the public sphere, most of the debate concerning a new publicly initiated fund has revolved around where the organization is to have its main offices. What is more interesting, is how the fund will actually be structured, and what mandate it is to fill. Depending on how the fund will be configured, it can fulfill much of the same role as outlined for a new green investment bank. The exact organization and financial toolbox of the fund is yet to be decided, and will not be made public until the National Budget is released in the fall of 2016. While the politicians examine these aspects in greater detail, we discuss the very same topics in the case of a green investment bank.

#### This is what we know about the plans for Fornybar AS:

- The fund will invest in green technology that directly or indirectly contributes to reduction of GHG emissions, and contribute to reach the national climate targets.
- The fund will co-invest with private actors and not be the majority owner.
- The fund will complement existing initiatives and seek to create additional value.
- The fund should not have subsidy elements.
- The fund will invest in new technology projects in the transition between the development and commercialization phase.
- The fund is with time expected to match market returns, but is acknowledged to take higher risks than market-based financial actors to achieve the desired effects.
- The fund can take a broad approach to the type of investments and geographies to maximize returns. Regardless, the fund will be anchored in a national context.

## NEED FOR A GREEN INVESTMENT BANK

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The Norwegian government owns a broad range of public funding agencies, of which some are especially relevant for green competitiveness. As mentioned, there is an ongoing process to map the state of the current public funding system and what measures that can be taken to improve collaboration across the various agencies. The establishment of a new GIB should complement and amplify the competencies and resources provided by these agencies. In this part, we will look at what gaps the GIB can fill and how synergies with the current system could lead to increased value creation.

### OVERVIEW OF CURRENT PUBLIC FUNDING SERVICES

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There is a number of different funding agencies which are set up to support firms with the abilities to innovate for sustainability. Findings from the empirical analysis show that the system to a large extent covers the needs of the current market, but that there is a gap for existing schemes and incentive programs to channel investments in business model innovation for sustainability. Central for many governmental agencies is the principle of being technology neutral in order to avoid interference with market mechanisms. The projects are evaluated on equal terms through set criteria. Thus, the market will be responsible for picking the “winners” among the technologies that have received governmental support. Other agencies are more specialized, with mandates to support specific technologies. The GIB will join the latter group and seek to invest in selected sectors. Figure 1 shows the agencies deemed most central for enhancing green competitiveness for Norwegian industry, along with the funding gap in the valley of death.

#### THE VALLEY OF DEATH

The valley of death is a common term to describe the gap in the transition from the early development phase into large-scale pilot testing and demonstration. As illustrated in figure 1, the valley of death shows the gap of funding on the technology maturity scale, but also displays the gap between public and private funding.

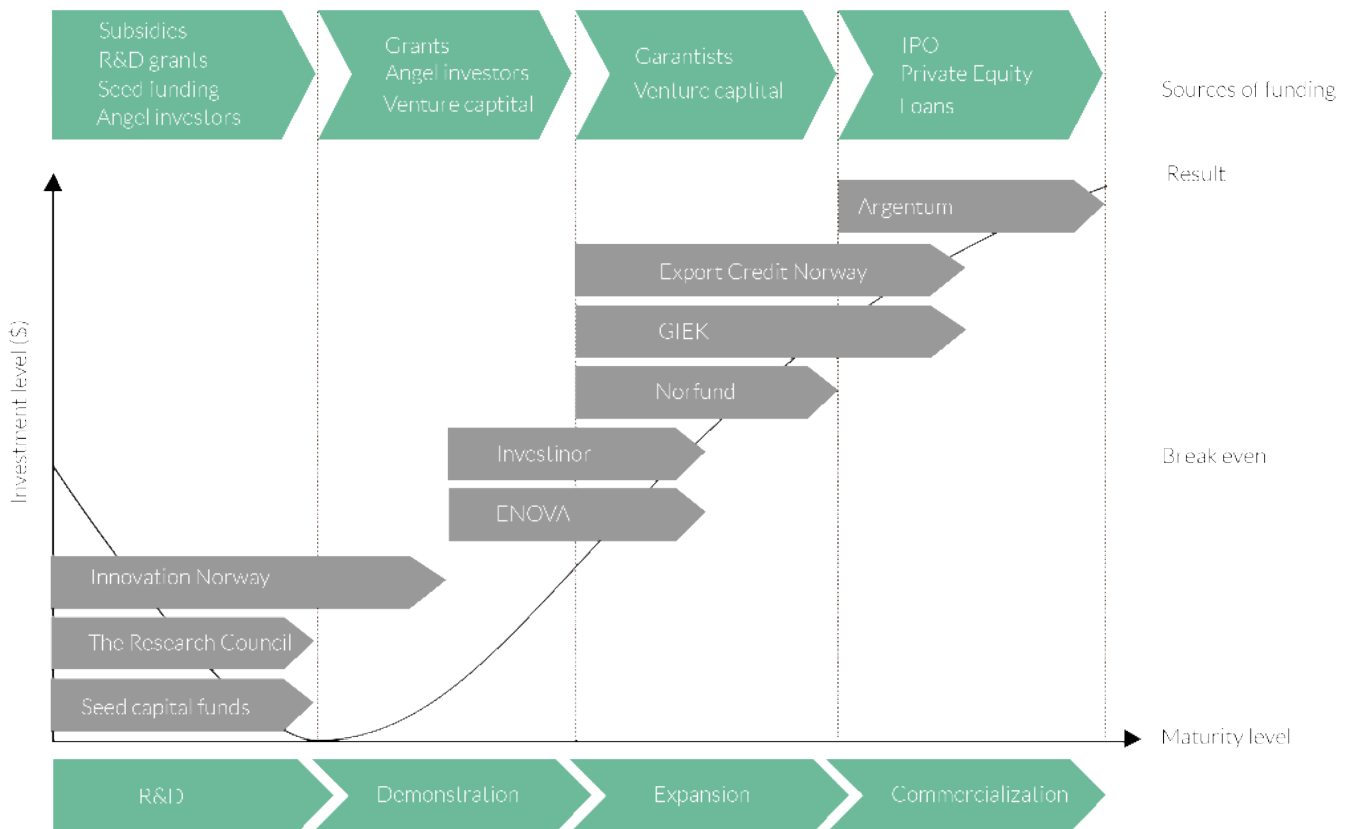


Figure 1: Norwegian public funding agencies

As seen in the figure, The Research Council of Norway, Innovation Norway, Enova, The Norwegian Export Credit Guarantee Agency (GIEK), Export Credit Norway, Investinor and Argentum all together provide funds in different stages of the technology maturity scale. In addition, SIVA and the interest organizations Intsok and Intpow complement the innovation system. All the mentioned public agents have important roles to fill in the transition to a low carbon society. Some have already started, and others are on the verge to expand their mandate to increase collaboration and make the process for sustainability innovators easier. However, none of the funding agencies are specialized to mobilize a sufficient amount of private capital to sustainability projects in the most critical phase, the valley of death. Norwegian industry thus needs a new tool to bring up the pace without exhausting current public funding pools.

## STATE OF THE CURRENT SYSTEM: TOO LITTLE EFFECT TOO SLOWLY

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### Evidence from our empirical analysis highlighted some weaknesses in the current system:

1. The leverage ratio of private capital to the level of public funding is too low.
2. The time frame from idea to market introduction of relevant technologies and business models is too long.
3. The commercialization rate of research projects that make it from concept to proven technology is too low.

To reach Norway's climate targets, but also to benefit from innovations commercially, there is a substantial need to increase the amount of private capital per public funds invested. Private capital is crucial to upscale the right solutions at a faster pace. The Norwegian market lacks an influential institution that can coordinate efforts, and align the flows of public and private capital into prioritized target areas for green technologies. To create green competitiveness, sustainable business needs to enter the marketplace faster. It is therefore crucial to reduce the time necessary to drive forward innovations for commercialization. Norwegian funding agencies are strongly positioned when it comes to the research and development phase, but the valley of death kills too many of the pilot projects derived from the research efforts. To some extent, this can be considered a beneficial effect since only the projects that are proved viable by the market will survive. However, innovations with a massive business potential are often stranded

or sold to foreign companies to be developed further internationally. The consequence is that the cost-intensive nature of Norwegian business environment drives many actors abroad before they get a chance to create value and jobs in Norway. Investments made by public funding agencies become a sunk cost without generating neither jobs nor returns over time. This largely undermines the intention of the grants provided for research projects. Commercialization of pilot projects on a national arena is therefore crucial to secure and benefit from the resulting value creation. A GIB can here adopt a different approach from that of many grant-making public institutions, and instead follow strict mandates to mobilize private capital. A GIB tailored for sustainability investments will thus realize the full potential of public investments and help prioritized projects over the valley of death. An example of a company that is currently in the valley is Zaptec. A snapshot of the company is given in Spotlight 2.



## SPOTLIGHT: Zaptec

*Being at the verge to take their next giant leap towards commercialization, Zaptec and their electronic transformer technology is one of Norway's most interesting green technology companies.*

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### Key facts:

Company name: Zaptec

Year established: 2012

Industry: Power electronics

Location: Stavanger

***“We need the financial muscles to play the Big Game.”***

– Brage Johansen, CEO

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### The next big step: from demonstration to commercialization

Zaptec is in the business of democratizing energy by enabling new forms of distribution and consumption. Thanks to the flourishing market for electric vehicles, the company has had a home market to develop and test their solutions. The technology is a result of over ten years of research and development, and has now reached the dramatic phase when focus is diverted away from product development to sales and marketing.

***By making this move, Zaptec is getting into the feared valley of death.***

As a company with a promising outlook, Zaptec has benefited from angel investors, an investor group which is rather rare in the Norwegian capital market. Angel investors are important to lift technology that is not yet mature enough for venture capital. Zaptec has experience with several of the public funding agencies, and has received support from Innovation Norway and Enova (previously Transnova). The application and documentation process to the Research Council proved too difficult and resource intensive in the absence of specialized competence with application submission.

Zaptec is positioned for growth, and looks to expand into new, international markets. In this phase, the company will seek venture capital from a new investor community compared with previous rounds. When asked about the need for a green investment bank, a long-term loan facility is highlighted as a valuable mechanism for an entrepreneurial company destined for growth. Ideally, such a bank would consist of a small group of specialized employees to execute efficient project management, and serve as a useful partner for maturing companies.

***“I am very positive to a specialized, green institution. This would be capital with a purpose. There has to be a purpose with what you do. If profit is the main driver, you might as well get into the drug business”. – Brage Johansen, CEO***



## SECTORS FOR GREEN COMPETITIVENESS

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### Exporting green high-tech

Looking from a geographic and natural resource perspective, Norway has unique advantages through abundant access to hydropower and marine resources like aquaculture and petroleum. Historically, these advantages have been the basis for the creation of a strong welfare-economy, and now serves as a great starting point for the transition to a low carbon society. We have the financial muscles to make the necessary investments in industry development and infrastructure, abundant access to clean energy, and world-class expertise within selected sectors. The electricity prices are low compared to the rest of the world, giving process industry a competitive advantage through their low carbon footprint. In the task to enhance green competitiveness, some sectors are better positioned to effectively contribute to national climate targets, job creation and boost economic growth. Moving forward, these sectors should be prioritized. The choice of sectors could be seen in connection with the possibilities to export technology and expertise internationally. A green economy is dependent on a shift towards increased export of high-tech solutions in renewable technologies and advanced low carbon systems and products.

### Multi-target focus areas

Norwegian industry has already invested billions in key sectors as a part of the green transition. One of the main objectives of the GIB should be to optimize the use of public funds. This is done by targeting investments in sectors that fulfil multiple focus areas for green competitiveness. The multi-target areas can guide innovation efforts, and

thus the concentration of both public and private investments. The multi-target areas satisfy industry development in Norway and has the potential to contribute to large-scale emission reductions both nationally and internationally. The most important areas should address three key issues that characterize the current marketplace and political challenges:

#### 1. Climate policy:

Fulfillment of national climate obligations require largescale investments. Especially within the four largest sources of GHG emissions: transport, oil & gas, process industry and agriculture.

#### 2. Innovation:

In addition to incremental performance and efficiency improvements, there is a need to introduce disruptive technologies which make radical changes to current practices.

#### 3. Decline of oil and gas:

Plunging oil prices have shaken both Norwegian industry and economy, and a highly skilled workforce has gone from lucrative industry jobs to be numbers on the rising statistics of unemployment.

Consequently, the following criteria were found to be central to identify the most promising sectors:

- They address the largest emission sectors both in Norway and globally.
- They utilize highly skilled human resources and industry insight.
- The geographical advantages and natural resources are exploited sustainably.

## Relevant sectors for reducing CO2-emissions

IEA has mapped the necessary reductions in CO2-emissions to reach the two-degree target for the sectors of power, industry, transport and buildings (see appendix A). The reduction targets in the analysis are accompanied by the most promising technologies to realize these reductions. The largest potential is found using clean production technologies, with over twice as big potential as the industry sector. Zero emission transport is the sector with the third largest potential. When it comes to CO2-reducing technologies, renewable energy in power production is superior to other options. Energy efficiency gives a substantial potential for reductions in both the industry and transport sector. Furthermore, energy efficiency needs to be prioritized so that it can complement and reinforce the effectiveness of other solutions. The importance is neatly summarized by the pioneer behind the first solar airplane, Bertrand Piccard:

***“There is no logic in filling a bathtub without plugging the drain first. Electrification and clean energy production therefore needs to be implemented in parallel with energy efficiency measures.”***

*- Bertrand Piccard, Solar Impulse pioneer*

## Identifying promising sectors for green competitiveness

In addition to address the largest emissions sectors, multi-target areas also focus on the aspects of exploiting industry expertise and resource-based geographical advantages.

Together, they characterize areas where Norway has a competitive advantage. In our empirical analysis, the respondents were asked which sectors were considered to be most promising on the path to achieve green competitiveness. Figure 2 shows the most central target areas and sectors derived from the analysis.

### **Technology areas:**

Promising areas for technology development that will strengthen the green competitiveness of Norwegian firms nationally and internationally.

### **Industry sectors:**

Domestic industries that build on one or several technology areas. As an example, green shipping include the use of battery and charging technology, new ICT solutions and clean energy production.

### **Strategic areas:**

Based on the identified technology areas and industry sectors, the areas show where Norway has the opportunity to reduce carbon emissions while enhancing industrial competitiveness. By targeting these strategic areas, core competence and industry experience will be used to create new innovations for a home market and international export.



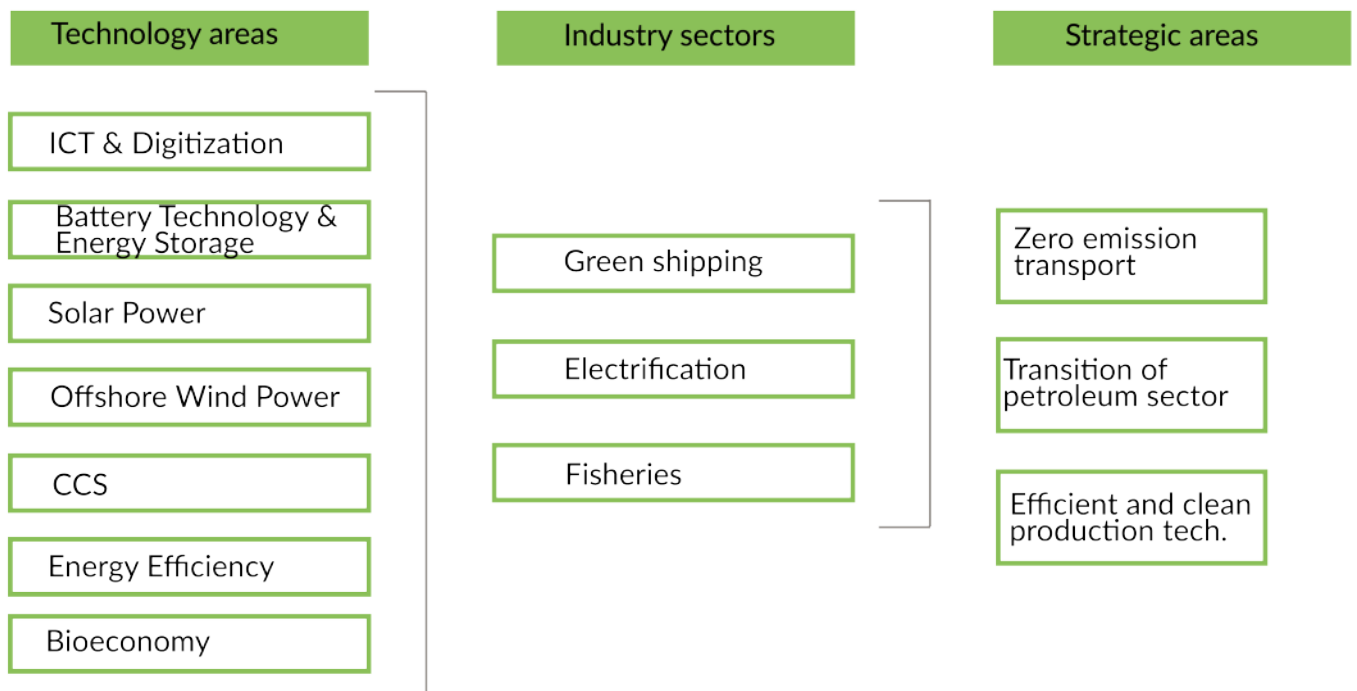


Figure 2: Strategic areas derived from the most promising technology areas in the empirical analysis.

As seen in figure 2, battery technology and energy storage was the most frequently mentioned focus area. Secondly comes electrification of the process industry, followed by solar power. To summarize, these sectors can all be said to constitute high-potential sectors positioned to create a competitive advantage for Norwegian industries. Based on empirical findings, three strategic areas are presented in figure 2. Building on this, we identify the following multi-target areas: distributed energy and storage systems, low carbon process industry, hydrogen production, electrification and energy efficiency, floating offshore wind, green shipping, greening of cities, aquaculture, digitalization and IT solutions. A closer description of these areas can be found in the appendix A. Targeted investments and innovation efforts in these sectors could give a large impact on global CO<sub>2</sub> reductions, and also entails major business opportunities.

## TECHNOLOGY AREAS

**Bioeconomy:** production and processing of biologically renewable resources.

**CCS:** Technology development related to the value chain of carbon capture and storage.

**Solar power:** technology development of the core technology, raw materials, or the development of large-scale facilities.

**Offshore wind power:** technology development in supplier industry and operating responsibility of utilities. Conventional or floating technology.

**ICT & digitization:** enabling technologies such as smart grid technology and big data.

**Battery technology:** entire value chain related to development, production and infrastructure of energy storage, charging and transmission technologies.

**Energy efficiency:** Energy efficiency includes enabling technologies that help reduce energy use among consumers, business and industry.



**PART 3**

# **CONSIDERATIONS FOR A NEW GIB**

## MAIN CONSIDERATIONS

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*There are many factors to consider when deciding which configuration would be most suitable for the establishment of a Green Investment Bank. Main considerations will be introduced in this section, including the following:*

- Nordic versus Norwegian GIB
- Private or public entity
- International versus national scope
- Building the right competence
- Project size
- Financial instruments
- Sustainability communication

***“Going forward, we will seek to build on this progress as well as focus our efforts on combining our public resources with smart policies to mobilize much larger flows of private investment in low-emissions and climate resilient infrastructure.”***

*- US President Barack Obama*

## GLOBAL ROLE OF GREEN INVESTMENT BANKS

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Before introducing the main considerations for a GIB in Norway, this section will describe the global role of these investment institutions. The emerging movement of specialized Green Investment Banks aims for public-private collaboration to excel investments in clean energy markets. Some GIBs are also termed Energy Investment Partnerships or Development Financial Institutions (DFIs). These entities have the potential of “convening stakeholders, mitigating risk, supporting the development of more projects ready for investment, and supporting effective policy that reduces risk for clean energy investments”. Major forces worldwide are working to shift the focus of the financial sector towards a greener economy. In the climate action plan from 2013, President Barack Obama emphasized how mobilizing climate finance would be an important tool in the US’ efforts to promote sustainable development.

Since 2013, a large number of GIBs have been established or are in the process of being established. With UK Green Investment Bank as a pioneer, the diverse range of GIBs have mainly been established to facilitate private investments into low-carbon, climate-resilient (LCR) infrastructure. While GIBs have different approaches, they usually share the following characteristics:

- A narrow mandate focusing mainly on mobilizing private LCR investment by using interventions to mitigate risks and enable transactions.
- Independent authority and a degree of latitude to design and implement interventions.
- A focus on cost-effectiveness and performance reporting.

The potential impact of GIBs extend across environmental, fiscal, social, and physical boundaries. “Through forming partnerships and addressing the diverse needs of stakeholders, GIBs contribute to valuable direction towards reducing the need for public capital in the transition to a clean energy economy. ” With the authority to raise capital through a variety of means, GIBs can align clean energy finance initiatives with traditional development financing tools. This maximizes the impact of public funds to accelerate the implementation of clean energy technology and economic development. Table 1 shows an overview of the largest Green Investment Banks currently established.

**“The majority of the GIBs that have been established are not actually banks. They don’t hold the banking rights, as they don’t allocate capital according to a banking model. The banks are just fund structures, with a slightly different capital structure. They get funding from the central government, but are essentially funds structured as companies.”**

*- Gregor Paterson-Jones, former  
Managing Director of UK GIB*

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- A narrow mandate focusing mainly on mobilizing private LCR investment by using interventions to mitigate risks and enable transactions.
- Independent authority and a degree of latitude to design and implement interventions.
- A focus on cost-effectiveness and performance reporting.

Green Investment Banks worldwide						
GIB or GIB-like entity	Origin	Leverage factor <sup>1</sup> Accomplished / targeted	Toolbox: Financial instrument			Initiator
			Loans <sup>2</sup>	Grants	Other	
UK Green Investment Bank	UK	1 : 3/ 1:10-1:20	●			UK Government, Department for Business, Innovation and Skills.
Swiss Technology Fund <sup>8</sup>	Switzerland	1:1			Guarantees	Swiss Confederation
The Clean Energy Finance Corporation (CEFC)	Australia	1:2/ 1:10	●		Venture capital <sup>3</sup>	Australian Government
The Green Finance Organization	Japan	N/A	●			Japanese government, Ministry of Environment
Malaysian Green Technology Corporation	Malaysia	N/A	●	●		Ministry of Energy, Green Technology and Water
South African Green Fund	South Africa	N/A	●	●	Equity	South African government, Department of Environmental Affairs
Connecticut Green Bank	Connecticut	1:10	●		Securitization, leasing	Governor and Connecticut's General Assembly
NY Green Bank	New York	1:5	●		Credit enhancement	New York State Energy Research and Development Authority, (NYSERDA)
Green Energy Market Securitization (GEMS)	Hawaii	N/A	●			State of Hawaii, Department of Business, Economic Development and Tourism and the Hawaii Green Infrastructure Authority
New Jersey Energy Resilience Bank	New Jersey	N/A	●	●		State of New Jersey
California Lending for Energy and Environmental Needs (CLEEN)	California	N/A	●		Tax-exempt bonds	The California Infrastructure and Economic Development Bank (iBank)
Rhode Island Infrastructure Bank	Rhode Island	N/A	●			Rhode Island General Assembly
Montgomery County Green Bank	Montgomery County	N/A / 1:20			N/A	Department of Environmental Protection (DEP)
Masdar <sup>5</sup>	Masdar City	N/A	●		Venture capital	City of Masdar
<b>Total</b>	<b>14 GIBs</b>	<b>8 countries</b>	<b>12</b>	<b>3</b>		<b>6 governmental, 6 state, 1 county, 1 city</b>
<b>Other initiatives and proposed GIBs</b>						
US Department of Energy Loan Guarantees	US	1:10				Operative
Low Carbon Australia	Australia	1:13				Operative, now transferred to CEFC
State GIBs	Vermont, Delaware, Maryland, Ohio, Nevada, Minnesota	-				In establishment
US Green Bank	US	1:10				Proposed by Clean Energy Deployment Administration
National Green Development Fund	China	-				Proposed by the China Council for International Cooperation on Environment and Development (CCICED)

1) Leverage factor indicates the public:private ratio, or how much private capital is attracted per public investments. N/A implies that the information is unavailable, usually since the GIB is too new for a track record. Sources from OECD (2015), ACF (2015, p. 5) and email correspondence with Montgomery County Green Bank and the Swiss Technology Fund.

2) All loans are generally market loans on commercial terms and rates, except a few that also utilize concessional loans.

3) Clean Energy Innovation Fund (CEIF), planned operative on July 1st 2016 (CEFC, 2016).

4) Grants and forgivable loans will be offered to address up to 40 percent of unmet funding needs, while low-interest, amortizing loans will be available for the remaining 60 percent of unmet funding needs (NJ ERB, 2014.)

5) Masdar Capital manages two investment funds: Masdar Clean Tech Fund and DB Masdar Clean Tech Fund (Masdar, 2016).

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As seen in table 1, there is a broad range of investment banks established already. The “Leverage factor” column shows the ratio which measures how much private funding is unleashed per public investments. GIBs are still in a very early development stage, but the scarce track record available shows a significant effect of mobilized private capital. Connecticut Green Bank currently has the largest leverage ratio with ten times higher private than public capital. As the columns shows, the targeted leverage ratio is much higher than current levels. Also worth mentioning is the fact that some GIB-like entities (e.g. GreenTech Malaysia) make extensive use of concessional loans. Other GIBs like CEFC and Connecticut Green Bank give market loans, and only use the more generous loans on a limited basis. An observation is that none of the GIBs have been established across national borders, but have been founded on a national level, state level, county level or city level. Examples of GIB’s efficiency can be found in appendix B.

The Green Bank Network is a global network of green banks that collaborate with the objective to exchange experiences and scale up private financing that meets the challenges related to climate change . The currently largest gathering of GIBs happened during the GIB workshop at COP21 in Paris.

GIBs are not the only institutions that can mobilize investments in domestic LCR infrastructure. Alternatives to GIBs are usually found in entities like National Development Banks (NDBs), public investment banks, infrastructure banks or industrial development banks that focus

on domestic investment. Usually, NDBs are less focused on mobilizing green investments than GIBs, but some NDBs have financed low-carbon projects for many years. Some NDBs, such as Germany’s KfW, as well as multi-lateral Development Banks like the European Investment Bank and others, increasingly innovative tools to scale up private finance from multiple investor classes. As an example, KfW has invested in environmental protection domestically and internationally since the 1980s, and invested approximately US\$ 58 billion in domestic low-carbon projects in 2010-12 . Other initiatives like The South Pole Group also make significant contributions, for instance by screening over \$1 trillion investments and assets regarding their climate impact .

### **PARTNER FOR INSTITUTIONAL INVESTORS**

GIBs can create attractive opportunities for institutional investors such as insurance companies, pension funds, investment funds, public pension reserve funds, foundations and endowments. Only in OECD countries, these investors held US\$ 93 trillion of assets in 2013. While these investment actors typically seek long-term and low risk investments, they are hesitant to be the first mover into new markets or take construction risk. However, if co-investing with a GIB, they could benefit from the attractive market opportunities created by public-private collaboration for sustainable and climate resilient infrastructure.

## NORDIC VERSUS NORWEGIAN GIB

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The Nordic countries can benefit from joining forces for a Nordic Green Investment Bank, but also face substantial challenges. Advantages and dis-advantages need to be thoroughly explored to get a better insight into the complex nature of collaboration across borders. Considerations related to this will be discussed in part 4: Scenarios. An optional approach that emerged from the empirical analysis, was to move the scope from nations to cities (see fact box). Collaboration on a city level has proven to provide larger agility and quicker implementation of low carbon solutions, and many nations actually have more ambitious climate targets than the nation as a whole has committed to.

### COLLABORATION BETWEEN CITIES

Another option deviated from the empirical analysis was to look beyond the scope of nations to collaborations between cities. This could open up for the potential to exploit the Nordic comparative advantages in management knowledge and environmental competence. The flexibility to make large investment decisions quickly makes them more suitable drivers to catalyze change. An example is the initiative Cities for climate sparked during COP21. The network gathers local leaders unites 1000 cities that pledged to long term climate goals such as becoming 100% renewable or reducing CO2 emissions by 80% within 2050. Collaboration between cities has also been a driver for EU's main climate innovation initiative, Climate-KIC. Collaboration and exchange of experiences across city borders will speed up the green transition for smart cities.

Sources: Zaptec, Cities for climate (2015)

## INTERNATIONAL VERSUS NATIONAL SCOPE

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The GIB could focus on a national or an international scope. However, they do not have to be mutually exclusive, so a weighted combination of both is possible. The empirical analysis revealed the significant value of a home market when firms internationalize. Three examples are the incentives for electric vehicles, the drive to electrify ferries and the advanced fleet of supply vessels developed in the wake of the petroleum industry. They are all examples of investments conceived in Norway, that have sparked global curiosity and international business development. The opportunity to develop marine electrification brought the Canadian company PBES to Trondheim, as seen in Spotlight 3. By having a proof of concept at home, both established and new firms get the credibility necessary to win contracts abroad. To deliver stable returns over time, a potential business model for the GIB emerged during the empirical analysis: It could invest in and coordinate a cluster of Norwegian firms in international operations to cover the demand of renewable energy that occurs from some of the most influential companies worldwide. An example is collaboration with RE100 (see fact box). The main focus of the GIB would then be to invest for the successful expansion of Norwegian industry abroad.

### COLLABORATION BETWEEN COMPANIES

The private sector accounts for around half of the world's electricity consumption. To shift companies' energy consumption to renewables, RE100 is an initiative by The Climate Group and CDP for companies that have committed to implement 100% renewable power supply for their operations by 2020. The network seeks partners to address barriers and develop transparent reporting mechanisms, while showcasing business action. When all the firms in RE100 demand solutions for renewable energy production, there will be a massive pull for renewables locally, with associated holistic solutions for distributed energy. This could be linked to securitization, and bundling of both projects to finance distributed energy. Firms from the empirical analysis like Powel, Scatec, Statkraft, Statoil, Zaptec and PBES are all eligible to pilot business opportunities with customers that seek to become clean power producers. Additionally, institutional investors like KLP and Storebrand have implied that they could consider to invest in such an entity.

Sources: KLP, RE100 (2016)



## NORDIC VERSUS NORWEGIAN GIB

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Findings revealed broad consensus that the private sector needs to collaborate closer with governments and regulators to accelerate financing for sustainable development. Such public-private partnerships will “scale up the use of finance and industry models that lower financing costs for low-carbon energy and energy efficiency investments, particularly for institutional investors”. The GIB could therefore become an intermediary to bridge the gap with a configuration that fits the needs of both the public and the private sector. The importance of independency becomes clear when discussing the GIB’s affiliation, since it needs to be able to operate on commercial terms without political interventions.

## GREENING EXISTING INSTITUTIONS OR CREATE A NEW ENTITY?

The “Greening” of existing institutions may be preferable to creating a new institution when the necessary institutional and political support exists. Some factors to consider when evaluating the need for a new GIB include:

- Costs and time required to establish a new institution is likely to exceed the equivalent of greening an existing institution. It could also be perceived as expanding bureaucracy or creating duplicative government services.
- The independent status of a new GIB can provide flexibility to experiment, innovate and adapt to market development. Independence shields the institution from political interference, which could be vital to attract long-term capital from institutional investors.
- “Mainstreaming” sustainability investment objectives in existing institutions could be considered. In Norway, potential resources are Investinor, Argentum or Norfund. In the Nordics, NIB and NEFCO are candidates. Resources would probably be saved in structure and human resource availability, but internal resistance could be strong against changes that may conflict with current procedures and expertise.
- Organizational culture and mandate: Current agencies lack a clear mandate to promote sustainability, climate change adaption and mitigation. GIBs usually have crystal clear mandates and thereby attract human resources with the mindset fit for the purpose. It might be easier to build the right organizational culture from inception rather than changing an existing one.

Source: OECD (2015)



## SPOTLIGHT: PBES

*With Canadian technology manufactured in Trondheim, PBES is an excellent example of how a foreign business is looking to Norway to realize the energy storage solutions of tomorrow.*

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### Key facts:

Company name: PBES Norway AS

Year established: 2015

Industry: Energy storage

Location: Trondheim/Vancouver

**“Norway has the demonstrative commitments that few others can match”. – Brent Perry, CEO**

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### Joining efforts: An international take on the energy storage revolution

Norway’s pledge to achieve zero emissions from the transport sector is sparking interest not only on a national arena, but has also attracted international business to set foot in the Norwegian market. One of these is the Canadian Company Plan B Energy Storage Ltd. While initially being developed in Canada, They have now established a Norwegian Company to directly support the Norwegian Market with Assembly, Service and Engineering. The move over the Atlantic Ocean was based on the presence of related industry and a network of potential customers and large technology actors to excel the developments in marine electrification.



### Making champions of their customers:

At the core of the business model is quality and long-term customer relationships. The technology is openly shared with integrators, and end-users educated and supported throughout the product life-time. The goal is to give customers an advantage in the market place. This is PBES’ philosophy of a business that is in it for the long-haul.

The energy industry is changing at a rapid pace, and can appear chaotic for both incumbent and outside observers. This is one of the reasons why PBES has looked to secure private capital over public funding, which is sometimes too slow to follow the market developments. The process of getting funding in Norway has proven difficult, as high-risk projects needs support of larger actors like Siemens to account for the viability. Hence, for a company like PBES, non-dilutive growth capital in the form of a loan or convertible debt from a green investment bank would have a great impact.

**“We need the committed support of a financial institution that can participate in the evolution of the market and be flexible in their demands. There has to be room for adaption of the business plan along the way, and practical auditing requirements in return.”**

– Brent Perry, CEO

## BUILDING THE RIGHT COMPETENCE

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The GIB needs to attract world-class competence to succeed. It is of crucial importance to develop and maintain institutional knowledge to match the market requirements for the swift and large scale implementation of sustainable solutions. Candidates need to fit the GIB's profile as a driver for sustainability. As a whole, the employee base should cover all the relevant fields and have the capacity to overlap knowledge loss due to turnover rates. The number of staff could with advantage be limited, to allow the corporate culture of a dynamic and future minded team to prosper. Highly skilled in their respective fields and with a deep understanding of market mechanisms, the team should be given complete autonomy and responsibility to manage the GIB's portfolio under the requirements set by government. Flexibility to respond to market trends is a must, as well as the capability to be actively engaged in the respective projects.

## PROJECT SIZE

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Apart from determining which sectors that will be targeted by the GIB, another question is what criteria is to be set for projects to invest in. Large infrastructure projects are often capital intensive and require substantial internal resources to manage. If the GIB is to be heavily exposed in infrastructure, resources can easily be tied up, thus offering less flexibility to take on smaller projects. If choosing a model with many small projects, they can be bundled to achieve the desired rate of return, and will in turn offer a portfolio with diversified risk. Today, NEFCO has sound experience with bundling and management of small and medium projects. Their investments are based on transferring both knowledge and technological solutions in the areas of environmental and climate technology to local foreign markets. A similar model is possible for a GIB and would enable support to a high number of projects.

## FINANCIAL INSTRUMENTS

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GIBs are often tailored to become specialists with the necessary tools to scale up low emission solutions or spark sustainable innovation. The first case requires expertise in co-financing, the second lies closer to venture capital investing. There is a large difference in risks between the two approaches. In both cases, financial instruments can be tailored to reduce costs and risks to make the risk-return profile of the projects a better fit for investors. The GIB could become a specialist in the necessary tools to spark sustainable innovation and scale up low emission solutions. By either offering the instruments directly or through collaboration with other agencies, the GIB should be able to deliver a combination of grants, loans, venture capital, bonds, guarantees, know-how or necessary infrastructure to fit the prioritized sectors and projects. Tailored use of financial instruments will provide the necessary capital at the right project stage, which reduces the time necessary to commercialize sustainability innovations. Financial fit combined with market insight and active participation lowers the risks of failure and increases the systematic recycling of capital for new projects. Table 2 displays a list of financial instruments the GIB could use to reduce the costs of capital of sustainability investments and to maximize the attraction of private capital. The table is adapted from a New Climate Economy report by Zuckerman et al (2016).

Type of instrument	Instrument	Reduces financing costs by:
Financing vehicle	<b>Listed equity investment vehicle</b> (e.g. infrastructure fund) Tradable instrument providing an ownership stake in a group of clean energy projects	Reduces liquidity risk for investors
	<b>Bond</b> (e.g. bond fund, corporate bond, project bond, green bond) Investment that yields a stream of payments backed by a project's revenues, without ownership stake	Reduces liquidity risk for investors; investors are not exposed to risks that become relevant after the term of the bond (e.g. value of the project after initial useful life is over)
	<b>Concessional loan</b> Direct loan at below-market rate	Lowers cost of capital directly
Risk mitigation instruments	<b>Insurance</b> Offers protection against specific risks; can include policy/political risk	Shields investors from specified risks
	<b>Performance contract</b> Protects against risk of technology failure or underperformance; often offered by equipment manufacturers	Shields investors from performance risk
	<b>Currency swap</b> Agreement on a specified exchange of currencies in the future; counterparty assumes the risk that the exchange rate will fluctuate	Shields investors from currency risk by transferring it to the counterparty
	<b>Loan/credit guarantee</b> Agreement to cover some or all of an obligation to a borrower in the case of default	Reduces the potential losses that investors may face; can cover all types of risk
	<b>First-loss protection</b> Specialized insurance or cash reserve used to shield investors from a predetermined amount of loss	Decreases the likelihood that investors will be exposed to losses; can cover all types of risk
	<b>Co-financing</b> Can describe a range of financial arrangements where DFIs invest alongside private investors	Participation of DFI may lower private investors' perceptions of the riskiness of a project, including policy/political risk
Revenue sources	<b>Power purchase agreement (PPA)</b> Long-term contract to sell power at a fixed price (or with a minimum price or price collar)	Provides revenue certainty; avoids exposing renewables to fossil fuel price risk
	<b>Feed-in tariff</b> Long-term revenue support from government, at a fixed level	Provides revenue certainty; avoids exposing renewables to fossil fuel price risk
Capital cost subsidy	<b>Credit enhancement</b> Upfront subsidy to lower the interest rate paid by the borrower	Lowers cost of capital directly

Table 2: Potential instruments the GIB could use to reduce financing costs for sustainability projects. Modified after Zuckerman et al. (2016).

The green fields in table 2 indicate potential instruments the GIB could specialize in, provide knowledge of or coordinate with partners to reduce financing costs of clean energy projects. In addition to existing instrument, new guidelines could be utilized to combine these instruments in new ways. An example is CICERO's reports on climate-related investments in developing countries and climate adaptation. The first will present guidelines for how to maximize leverage of public:private investments using financial instruments available today. The second will clarify how climate change impacts investment decisions .

## SUSTAINABILITY COMMUNICATION

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Disclosure of the financial costs of environmental impact would make it easier for fund managers and analysts to assess and manage the materiality of companies' environmental impacts. Therefore, the GIB could be a driver for disclosure and implementation of ESG metrics in financial analysis. To address the firms' limited resources and prevent the phenomenon "death by reporting", the following tools for sustainability communication could be utilized.

*"With better information as a foundation, we can build a virtuous circle of better understanding of tomorrow's risks, better pricing for investors, better decisions by policymakers, and a smoother transition to a lower-carbon economy."*

- Mark Carney, Chairman of G20's Financial Stability Board

### Integrated Reporting

Integrated reporting is when firms disclose their sustainability impact by incorporating ESG factors in their communication, usually in the annual report or more frequently on the company website. It is a hybrid between the traditional, financially oriented annual report and the material parts of a corporation's sustainability report. Integrated reporting thereby gives a complete overview of the different dimensions of success: Financial, environmental, social and governance performance.

### Materiality and The Statement

Materiality is a fairly new sustainability concept which acknowledges firms' limited resources while simultaneously disclosing necessary sustainability issues. Materiality is often explained as focus areas of the highest importance for the company's sustainable value creation. The firm's significant audiences should guide which issues are "material" for the company to be sustainable.

A new movement promoted by Harvard professor Robert Eccles is The Statement of Significant Audiences and Materiality, which has been described through the empirical analysis. As part of their stakeholder mapping, companies should not only identify significant audiences, but also address trade-offs between stakeholders and the weighting assigned to each stakeholder. The Statement aims to prevent shareholder primacy, referring to the misperception that firms exist to maximize shareholder value, and that shareholder primacy is founded in the juridical duty of the Board. Contradictory to this, "a Board's duty is to the interests of the corporation itself rather than the particular audience of shareholders. The board must decide which audiences are most significant for the ability of the corporation to create value over the short, medium, and long term."

### Disclosure of which countries firms operate in

During the empirical analysis, transparency was found to promote sustainability investments. Participation will help gathering data necessary to perform extensive sustainability rating and gradually decarbonize asset portfolios. Related to this, another important finding from the empirical analysis, is the value of firms' disclosure of the geographic locations of its holdings, operations and employees. This simple piece of information would make it much easier for investors and fund managers to perform sustainability investing. We therefore propose that this information is included in The Statement, and updated on a quarterly basis.

*"The lack of transparency is the main barrier for achieving sustainability in business."*

- Nigel Iyer, investigator of fraud and corruption through 20 years

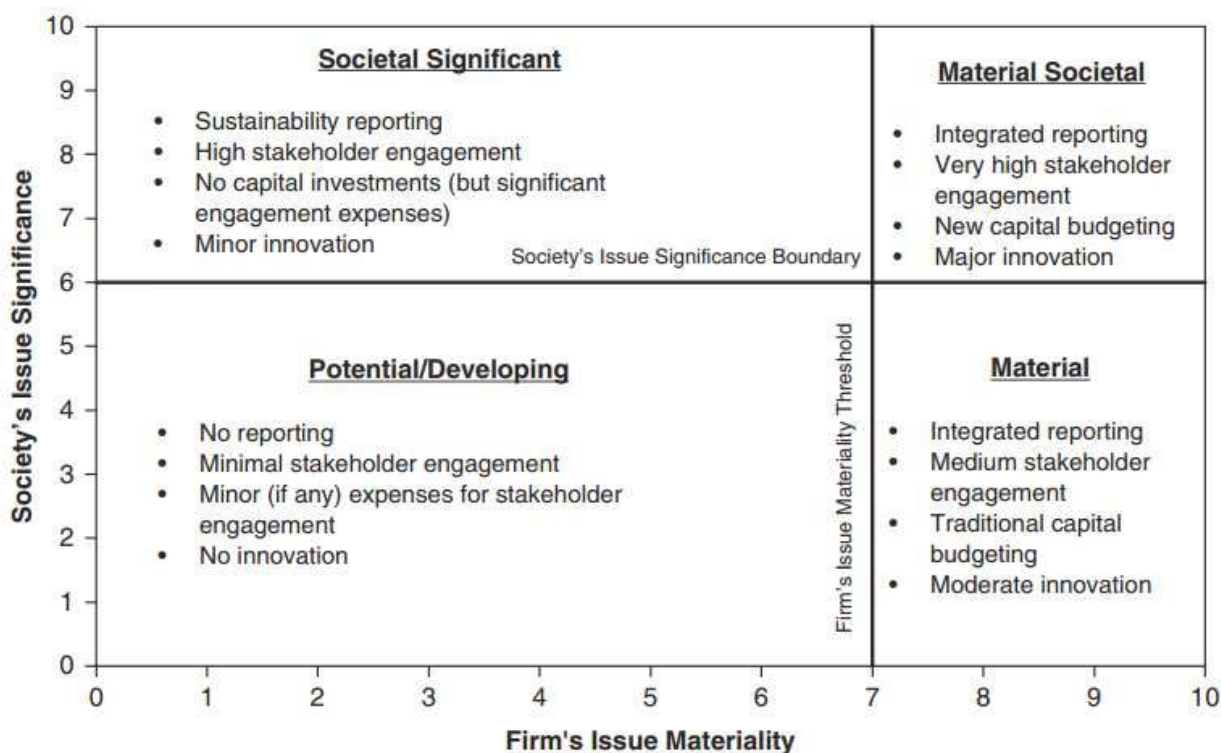
Therefore, increased transparency and ESG disclosure on a voluntarily basis could shift the trend from fighting corruption to preventing it. If high levels of transparency means good business, there will be a shift towards more transparent businesses.

### Sustainable Value Matrix

Another proposed management tool to build on materiality is the Sustainable Value Matrix proposed by Eccles and Krzus, as shown in figure 3.

The Y-axis contains the aggregated views of the firm’s chosen stakeholders, reflecting “society”. This is grounded in the Statement of Significant Audiences, as described in the previous paragraph. The X-axis represents what is deemed material to the firm. The matrix is divided in four cells by the “society’s issue significance boundary” and the “firm’s issue materiality threshold”

The most relevant issues for both stakeholders and the firm are found in the upper right cell, “material social”. Issues found within this box is to be included in the integrated report, and are in major need of innovation to resolve trade-offs between the needs of investors and other stakeholders. These are typically high-risk, long-term and capital intensive. Issues in the “material” cell are also subject for inclusion, while the “societal significant” issues can be placed in a separate sustainability report. The “potential/developing” issues can be ignored.



## Task Force on Climate-related Financial Disclosures

There are currently more than 400 sustainability initiatives, which makes it hard to implement and compare sustainability performance. The Financial Stability Board's Task Force on Climate-related Disclosures (TCFD) will launch recommendations to navigate the jungle of initiatives in December 2016.

*"The work of the Task Force on Climate-related Financial Disclosures will help to accelerate global investments in technological innovation and clean energy by increasing transparency. And, in doing so, it will help make markets more efficient, and economies more stable and resilient. "*

*– Michael R. Bloomberg, chair of TCFD*

The quote by Bloomberg, chair of the Task Force, summarizes what nations all over the world should strive for at this point of urgency. Norway needs to be a driver for change, and should therefore consider to commit one hundred per cent to the new indicators when they are launched. It will be one of the most efficient ways to achieve the targets from the Paris Agreement and UN's climate related Sustainable Development Goals. However, these indicators may only cover climate-related disclosure. All ESG values should be incorporated in businesses to secure true sustainable development.

### INTRODUCING THE MISSION OF THE TASK FORCE

The Task Force will develop voluntary, consistent climate-related financial risk disclosures for use by companies in providing information to investors, lenders, insurers, and other stakeholders. The Task Force will consider the physical, liability and transition risks associated with climate change and what constitutes effective financial disclosures across industries. The work and recommendations of the Task Force will help firms understand what financial markets want from disclosure in order to measure and respond to climate change risks, and encourage firms to align their disclosures with investors' needs.

Source: TCFD (2016)



**PART 4**

**SCENARIOS**



## NORWEGIAN CO-INVESTMENT PARTNER

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In this scenario, the GIB is a committed co-investment partner, often through joint ventures with other companies. Solid market expertise and understanding of local conditions offer support for a holistic approach to upscale technology abroad and drives the commercialization of infrastructure projects. The bank is perceived as a trusted investment partner with valuable sector insights, and gains recognition for reducing risks for private investors in challenging markets. The chosen investments coincide with and reinforce the objectives of Norwegian climate policies. In this scenario, Fornybar AS could be transformed to become a specialized GIB to amplify the efforts of Norwegian public funding agencies.

### **A public-private partnership**

In this scenario, the GIB is set up as a private entity with state affiliation through a steering committee and reporting requirements to the government. The configuration decouples the bank from political changes and is given the flexibility to fulfil the specified mission to invest in green technologies. The task of the government officials is to oversee the board and ensure that the given mandate guides the core business and daily operations. The GIB is anchored nationally, with the Norwegian state as a majority owner. Part ownership and collaboration is open to other institutions. With this model, the bank is positioned to co-invest with a wide range of partners on a national and international arena. Other green investment banks, funds and development banks are potential partners, along with large industry actors which look to invest in new infrastructure projects and other low-carbon technologies. For example, the Sovereign Wealth fund could become a resourceful partner for investments abroad.

### **Promoting the Norwegian brand**

The main advantages of a Norwegian GIB are the rapid establishment and tailored fit to promote Norwegian industry development. Norway has a head start in selected areas that few other nations can compete with. We also have the financial muscles to provide sufficient momentum for the GIB from inception. In close collaboration with

public agencies like Investinor, Argentum and NBIM, the Norwegian GIB can quickly become a driver for green competitiveness for Norwegian business. International expertise could also assist a Norwegian GIB to get an ideal blend of competence from inception. One of the drawbacks as opposed to a Nordic affiliation is that the GIB could not use the Nordic brand, which might be stronger positioned internationally than the Norwegian brand alone.

### **Internationalization: Unifying industry and climate policy**

Within this scenario, the role of the GIB is to follow Norwegian companies abroad as a trusted investment partner. This will benefit Norwegian export by upscaling technology and creating jobs at home and in the host country. The GIB offers sound expertise and is industrially oriented through its partnership and network collaborations. With the assistance of the GIB, Norwegian firms can overcome project and political risks. Through dialogue with foreign governments, it can seek to realize projects that would otherwise not be seen through. In this way, the GIB contributes to true additionality. Another benefit with foreign investments is the opportunity to combine the areas of industry policy with climate policy. The national targets of emission reductions that were pledged to the Paris Agreement can be met by investing in projects certified to yield carbon

by conventional financial institutions.

*“What we need are financing mechanisms that take projects that are blocked today and make them happen. This is true additionality - or enhanced climate action - as the Paris agreement envisages. There are many examples where developing countries want to do much more, but face project implementation barriers. Norwegian companies, with the assistance of our national financing institutions and funding dedicated to climate finance, can work with countries to overcome risk and make these projects go ahead. This would not only benefit host countries, but Norway could simultaneously discharge part of its national commitments under the Paris agreement.”*

- Terje Osmundsen, SVP Business Development Scatec Solar

credits. Development of new technology, new employment and international expansion are then coupled with climate policy objectives.

### Leveraging private capital through long-term loans

The role as a long-term investment partner is executed through the ability to provide capital loans, credit lines or act as a co-investor. With this toolbox at hand, the GIB will invest in proven technologies that can give high rates of success and decent, stable returns over time. Thus, the institution dismisses any subsidy element, and focuses on the development of promising industrial actors that is able to repay the debt within an acceptable time frame. This enables the GIB to recycle capital for new investments. It should however be noted that such a model might not give market returns after traditional requirements, and that the risks associated with the projects can be higher than the level accepted

## REALIZING HIGH-POTENTIAL INNOVATIONS

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The second scenario for the establishment of a green investment bank is an extension of the first scenario. The bank is still anchored as a Norwegian institution, but with an extended toolbox of financial instruments that sets ambitious requirements for organizational capabilities. The GIB has two main objectives: sparking and facilitating promising new innovations, and scaling up proven technological solutions. As a Northern newcomer in the family of GIBs, the entity will introduce and manage a novel financing concept compared to similar entities of this size. In this scenario, Fornybar AS could become a part co-financer and part venture capital investor inspired by the new innovation fund of CEFC and the Swiss technology Fund's guarantees for sustainable innovation.

### Building on scenario one

The structural configuration is largely the same as outlined in scenario one. The focus is still put on promotion of Norwegian technology through capital loans and export to foreign markets, with no form of grants. In addition to being an investment partner for companies that are in the expansion phase with proven technologies, the GIB is in this scenario also a development partner for entrepreneurial ventures that is yet to demonstrate large-scale commercialization opportunities.

### A hybrid entity

Essentially, the GIB will be able to cover functions that are usually limited to specialized entities. Of the existing public agencies, Innovation Norway has the financial means to support innovation in the form of both grants and loans. Investinor is positioned with venture capital for early phase developments, while Argentum targets mature companies. The new GIB is mainly set to distinguish itself from these actors in two ways:

- Scope of investments: The objective to invest in green technologies in targeted sectors.
- Financial means: The ability to combine venture capital and loans to assist at different stages on the technology maturity scale.

### Bridging the valley of death

Empirical findings suggested that there is a gap for funding in the phase from demonstration to

commercialization, the valley of death. The GIB's ability to offer venture capital in this transition phase will contribute to bridge the gap. If Norway is going to build new capabilities and competitive advantage in key sectors, new and promising technologies in these areas have to be supported to make it across the valley.

### Need for specialized competence

A hybrid model sets comprehensive organizational demands through the combination of venture capital investments and management of larger, international projects. Compared to scenario one, the organization has to be strengthened with skilled people experienced in venture capital investments. This calls for a specialized and effective institution with a limited number of employees to ensure agility. Furthermore, the exact structural configuration is dependent on the financial toolbox. The venture capital activities could for instance be put in a separate division, but with possibilities to disperse competence across the organization. Another keyword is sector knowledge, since this is crucial to pick the right projects for further development. Since several of the sectors highlighted in Figure 2 are emerging areas in rapid development, new competence needs to be developed continuously and institutional knowledge should be maintained over time. Even though there might be a limited resource pool in Norway, necessary competence could be found internationally.

## A NORDIC GREEN INVESTMENT BANK

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The third scenario looks outside Norway's national borders to join forces with the Nordic countries of Sweden, Denmark, Finland and Iceland. There is a clear technological and economical pathway for the Nordic region to push for carbon-neutrality in 2050. Together, the region can send a strong signal to the global community that the ambitious aims of the Paris Climate Agreement are achievable .

Establishment of a Nordic Green Investment Bank has some major advantages, but also entails obvious challenges. Assessments of the possibilities for such an entity have already been made, for instance through contributions by the Swedish Expert Group on Green Transformation and Competitiveness. The Nordic countries are minions in a global scale, so the nations will most likely be able to achieve more through joint rather than separate efforts. A strong, Nordic brand could benefit from experiences within business development and innovation. For Norway, valuable insights can be learned through entities like the Finnish innovation fund Sitra, the Danish CLEAN center and Swedish innovation pioneers. Between the Nordics, expertise in areas like wind, hydro, shipping, bioenergy, hydrogen, solar, geothermal energy and cold climate broadens the potential focus areas of the Nordic GIB. Collaboration and mutual knowledge exchange could make it easier to reach demanding targets and solve joint challenges.

***“Norway has a lot to gain from increased collaboration with the Nordics. Especially Copenhagen and Stockholm have been pioneers in creating hubs for innovation. It's not certain that Norway would benefit the most in such a relationship, but we clearly need increased knowledge exchange ”***

- Kristin Skogen Lund, CEO NHO

### **Building on existing ones or making a new configuration?**

In practice, recommendations for a structural configuration vary from restructuring the Nordic Investment Bank to creating a joint entity through existing Nordic banks. In the case of a new Nordic GIB, the proposed Fornybar AS could become Norway's financial contribution in the form of seed funding for the new or restructured entity. “From a Nordic perspective, the lack of both venture capital and funding for early stage project development has made it difficult to commercialize and establish reference projects for new technological innovations, domestically and in international markets”. Resources and expertise could be obtained from a broad range of banks like Nordea, DNB, Swedbank and SEB, as well as entities like the Nordic pension funds and green funds. A major advantage is the fact that the Nordics have already operated joint green finance institutions for decades. Experienced greeninvestment institutions like NIB and NEFCO would probably be central for the GIB, either directly or indirectly.

***“Nordic investors like the Norwegian Pension Fund (NBIM), the Nordic Development Fund, Nordic Investment Bank and the Danish Green Investment Fund all acknowledge climate change and to various extent co-invests in projects with positive environmental impact.”***

- Claudine Blamey,  
Head of Sustainability, The Crown Estate

Disadvantages of a Nordic GIB mainly concerns the challenges related to align all the countries' national priorities. With different motivations for commitment and deviating prerequisites, reaching an agreement might be difficult. Furthermore, comprehensive political processes might delay the launch and operation of the GIB. Delayed establishment is questionable in itself due to the urgent nature of climate change. A potential pitfall of a joint Nordic GIB are the cultural differences between the Nordic nations. Especially when financing is involved, even the best relations get tested if disagreements occur. The bold, action-driven business culture of Sweden and Denmark could potentially crash with the cautious approach of Norwegians.

***“Nordic collaboration is a minefield. There are much larger structural differences between countries like Norway, Sweden and Denmark than Norway and Australia or Norway and Canada.”***

- Brage Johansen, CEO Zaptec

To summarize, a beneficial relationship between the Nordics rests on mutual commitment for the promotion of Nordic technology. The success of a Nordic GIB would depend on the ability of the nations to make internal differences a strength instead of a weakness, which would make cultural variations the strongest card in the deck. If the result is broad expertise and accelerated thoroughness in the upscaling of sustainability technology, a Nordic GIB could provide a winning recipe. The alternatives for mandate and financial instruments available to a Nordic institution are the same as outlined in scenario one and two for the Norwegian GIB.

## ADVANTAGES

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1. All the Nordic nations have committed to ambitious climate targets.
2. A Nordic brand would have a larger recognition effect internationally, since “Nordic technology” and “Nordic know-how” have a wide reach.
3. Internationalization of climate technology and knowhow is critical to reach climate targets.
4. Combined, the Nordics have deeper knowledge within a broader specter than any of the nations hold individually.
5. Norway’s neighbors have know-ledge and strong track records within business development and innovation.
6. The Nordic countries face many of the same challenges related to raising private capital in the valley of death.
7. The combined population of nearly 27 million people increases the chances that relevant expertise and innovative projects are available in the GIB’s immediate network.
8. Nordic investment institutions already have significant experience in international communities.

## DISADVANTAGES

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1. Challenges related to tailoring NGIB to national priorities and ambitions.
2. Different motivations for commitment and various degrees of dedication may occur.
3. The time frame before the GIB could be established might take too long due to extended political processes.
4. Tensions might arise when attempting to split returns and benefits fairly. Which country should get how much of the weight divided on economic returns, jobs, domestic projects or participation of national industry clusters in international contracts?
5. The Nordic Banks could perceive the new GIB as a competitor.

**PART 5**

**RECOMMENDATION**



## CHOSEN SCENARIO

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Due to the urgency of climate change and the pressing need to shift Norwegian economy and industry towards sustainability, the recommended scenario is number two: A Norwegian Green Investment Bank that realizes high-potential innovations internationally. The approach is recommended to be a combined mandate to spark and facilitate promising innovations, and to scale up proven technological solutions. Even though the affiliation may be Norwegian, the GIB is recommended to initiate strong Nordic collaboration through partnerships on a city, company and project level. In this way, the speed of establishment and implementation of sustainability investments will probably be faster. The GIB would be flexible to ensure that Norwegian interests are maintained, but stands freely to drive for Nordic collaboration through a more pragmatic approach than the formalities of a joint financial institution.

### Communication toolbox

The GIB is recommended to consider using the following toolbox for communication to include ESG factors in its investment decisions:

- The Statement of Significant Audiences and Materiality
- Sustainability Accounting Standards Board (SASB)
- Sustainable Value Matrix
- Integrated Reporting
- Climate-related Financial Disclosures framework, to be launched by the end of 2016
- CICERO's frameworks on climate-related investments in developing countries and climate adaptation, to be launched by the end of 2016

These initiatives cover the necessary communication both internally and externally. However, the GIB could also consider using sustainability initiatives like UN Global Compact, UN PRI, CDP, the Equator Principles and GRI to be present in more established initiatives as well. An overview of these initiatives is provided in the Master's thesis.

### Sectors

Based on Norway's resource foundation, economic turnaround and political challenges, the GIB is recommended to prioritize three strategic focus areas:

1. Zero emission transport
2. The transition of the petroleum sector
3. Clean production technologies

To meet these strategic areas, the GIB is recommended to invest in multi-target focus areas. Selected multi-target areas are the following:

- Battery technology and energy storage
- Electrification of the process industry
- Distributed energy systems
- Green shipping
- Floating offshore wind

Additionally, greening of cities and buildings is a very reasonable and advantageous multi-target area. Vegetation reduces the peaks of flooding following heavy precipitation, improves air quality, regulates temperature and promotes social and environmental values. Floating offshore wind is a multi-target area that could be coupled with green shipping and the transition of the petroleum sector, but the opportunity cost of this needs to be thoroughly assessed due to the capital intensive nature of these investments. Technology areas that facilitate multi-target areas are digitization, IT solutions and energy efficiency.



## IMPLICATIONS FOR POLICY MAKERS

### Policy changes that promote sustainability

A broad range of stakeholders have expressed their impatience for sustainability solutions, both in the Norwegian society and internationally. Norwegian policy makers deserve recognition for the thorough assessments to find pathways for green competitiveness. Now the time has come to act. At the moment, we are no longer the first mover. But, as we learned in England: “The second mouse gets the cheese”. Norwegian politicians hold both the power and the responsibility to provide the necessary instruments to secure the competitiveness of Norwegian industry also in the future. The most efficient means to do this was found to be the following:

- Change governmental mandates and requirements to improve transparency and disclosure of ESG information.
- In the ongoing and future political processes, a unified political community should have the courage to think big, set a firm direction and take decisive steps to finance the green transition.

The government has every reason to do so, whether the arguments are founded in moral, ethical, climate-related or financial perspectives.

### Changed mandate of The Sovereign Wealth Fund

The Norwegian Ministry of Finance, acting as principal for the sovereign wealth fund SPU, should be acknowledged for a conservative approach to ensure the continuous growth of the Norwegian economy. However, the Norwegian industry currently faces challenges that demand carefully calculated boldness and the ability to drive the economy towards sustainability. SPU is already a pioneer among global Sovereign Wealth Funds (SWFs) in sustainability in asset

management (see fact box). This means that the fund’s actions and alternatively the lack of actions is followed closely by institutional investors worldwide.

### SPU: AN INTERNATIONAL SUSTAINABILITY PIONEER

In the report Finance Supporting the transition to a global green economy, UNEP identified the need for more support to help SWFs to incorporate climate risk considerations directly and systematically into their actual stock selection and portfolio construction processes. SPU was highlighted in UNEP’s report as a stellar example in this field: “The fund is a universal owner with a long investment horizon, and inherently has a clear financial interest in companies taking good corporate governance and environmental and social issues duly into account. Fiduciary responsibility for the fund also includes safeguarding widely shared ethical values. In the area of environmental issues, including climate change mitigation and adaptation, the fund employs the following tools: Research, an environmental investment programme and dialogue with companies.”

Source: UNEP (2011, p. 620)

### Policy changes that promote sustainability

A broad range of stakeholders have expressed their Norges Bank, through its asset management department Norges Bank Investment Management (NBIM), has become increasingly active to address sustainability issues. However, there is only so much the fund managers can do if the performance measurement is only financially grounded.

*“Active ownership considering climate risk, transition risk and unsustainable business models is not currently within our mandate. Politicians need to give us a new mandate if we should include this in our operations. The society needs to make this decision, not us.”*

- Yngve Slyngstad, CEO Norges Bank

Consequences of a changed mandate could entail permission to open up for investments in renewables through unlisted infrastructure, making ESG metrics an integrative part of investment decisions and promote active inclusion of sustainable projects or companies in the asset portfolio. Both Norges Bank and an independent expert panel selected by the Ministry of Finance recommended that SPU should be allowed to invest in unlisted infrastructure. The GIB could mitigate the regulatory and political risks associated with such investments, while SPU could provide the long-term financial muscles required to make a large impact on sustainability investments globally. Such partnerships have worked well for SPU before, for instance through collaboration with The Crown Estate when making investments in property like Regent Street in London. As investment partners, the GIB and SPU could become important drivers for green competitiveness in Norwegian industry. Another approach could be to expand the transparency index for Sovereign Wealth Funds to also include ESG values (see appendix C).

### **Active ownership in state companies**

As a majority owner in many large companies and entities, the Norwegian government could set more specific requirements that contribute to disclosure of ESG data. Transparency and ESG disclosure based on materiality is a recommended approach, since this will avoid waste of both financial and human resources. For institutional investors this could entail active ownership through clear expectations related to ESG metrics, divestment from carbon intensive firms and

## **REFLECTIONS AROUND SPU'S MANDATE**

The current mandate of SPU is the following:

**SPU safeguards and develops financial values for future generations.**

With this formulation of the mandate, the social and environmental considerations are not explicitly incorporated. To truly account for sustainability in their investment practise, we propose that ESG is more explicitly articulated in an alternative mandate. The following suggestion builds on current definitions of sustainable development:

**SPU safeguards and develops financial values for future generations within the planetary boundaries.**

active inclusion of best-ranked sustainability firms. Sufficiently large scale and systematic inclusion of firms with the best financial and ESG performance will contribute to catalyze the green transition of industry. For firms, simple communication tools like The Statement of Significant Audiences and Materiality or a Sustainable Value Matrix could make a huge difference for sustainability investors. All relevant entities could also be encouraged to implement state of the art frameworks for ESG inclusion, both referring to tools available today and the soon-to-arrive Climate-related Financial Disclosures and CICERO's two guidelines. When both investors, firms and intermediaries adopt sustainability integrated in business, the shift towards sustainability will undoubtedly speed up.-



## SPOTLIGHT: Storebrand

*The Norwegian pension fund is a global sustainability leader. With their practice to include ESG evaluation in asset management, sustainability has simply become a natural part of decision-making.*

### Key facts:

Company name: Storebrand  
Year established: 1767  
Industry: Pension fund  
Location: Oslo

**“Why do financial companies only talk of exclusions when talking about sustainability?”**

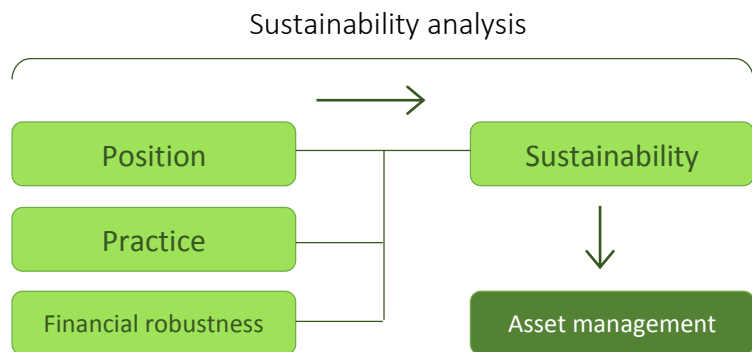
– Philip Ripman, Sustainability Analyst

### Best practice: A unique approach to sustainability investing

Storebrand is the second largest asset manager in Norway, second to the State Pension Fund, and has 570 billion NOK in its portfolios. For Storebrand, ESG is not something to be evaluated in a separate analysis – rather it is an integral part of everything they do. Storebrand’s approach covers three main activities:

**Exclusion:** In 2013, Storebrand was one of the first financial institutions to reduce their exposure in coal. But exclusion is not new to Storebrand, as the company has actively been doing this for over eight years. Up until now, 35 out of 180 company exclusions were made on the basis of having a poor sustainability ranking.

**Active inclusion:** In order to be able to invest in the best companies, three main criteria is used to evaluate the companies. A lot of time is spent to evaluate how companies are positioned for the challenges of tomorrow. How will the company meet global megatrends such as climate change and new policy regimes?



Source: Storebrand.no

Together with KPIs for internal practice and financial performance, all 2500+ companies are given “snapshots” of their overall sustainability in the context of their sector.

**Sustainability ratings:** Based on the methods to assess and make sustainability snapshot, Storebrand rate all companies within given sectors. All funds are then ranked accordingly, on a scale from 1 to 10 where 10 is the highest rank.

**“Firms that hold the highest rank incorporate sustainability in their strategies with a long-term perspective. The analysis has to be forward-looking, not backward-looking. We want the companies that are set for the future.”**

– Philip Ripman, Sustainability Analyst

## IMPLICATIONS FOR INDUSTRY

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Industrial actors need to take a lead in material transparency and disclosure of ESG metrics. For firms, simple communication tools like The Statement of Significant Audiences and Materiality or a Sustainable Value Matrix could make a huge difference for sustainability investors. This could of course be beneficial from a financial point of view, given that investors also adopt the habit of valuing financial and ESG performance. More importantly, it is only industry that has the means to scale up and innovate the necessary solutions that are needed to create a sustainable future. Private investors have to take responsibility and integrate ESG metrics in investment decisions, as a natural part of financial analysis. Moreover, with the financial support of a GIB, companies need to aim for business model transformations and market creating innovations for sustainability.

## CONCLUDING REMARKS

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Norway has the opportunity to embark on a new business adventure that may only occur once every millennium. We have the chance to make a significant positive impact and reinforce economic growth in the process. Through innovative business models and sound governance, Norwegian business could contribute to transform societies worldwide for the better, both financially, socially and environmentally. A Norwegian Green Investment Bank could become a pragmatic game-changer for green competitiveness. We have the chance to re-think business. Not because we have to, but because it's the right thing to do.

***“Norway should reclaim the position as a sustainability pioneer. Small countries can make a huge difference, all we need is a prudent strategy”***

- Asbjørn Torvanger, Senior  
researcher within climate finance, CICERO

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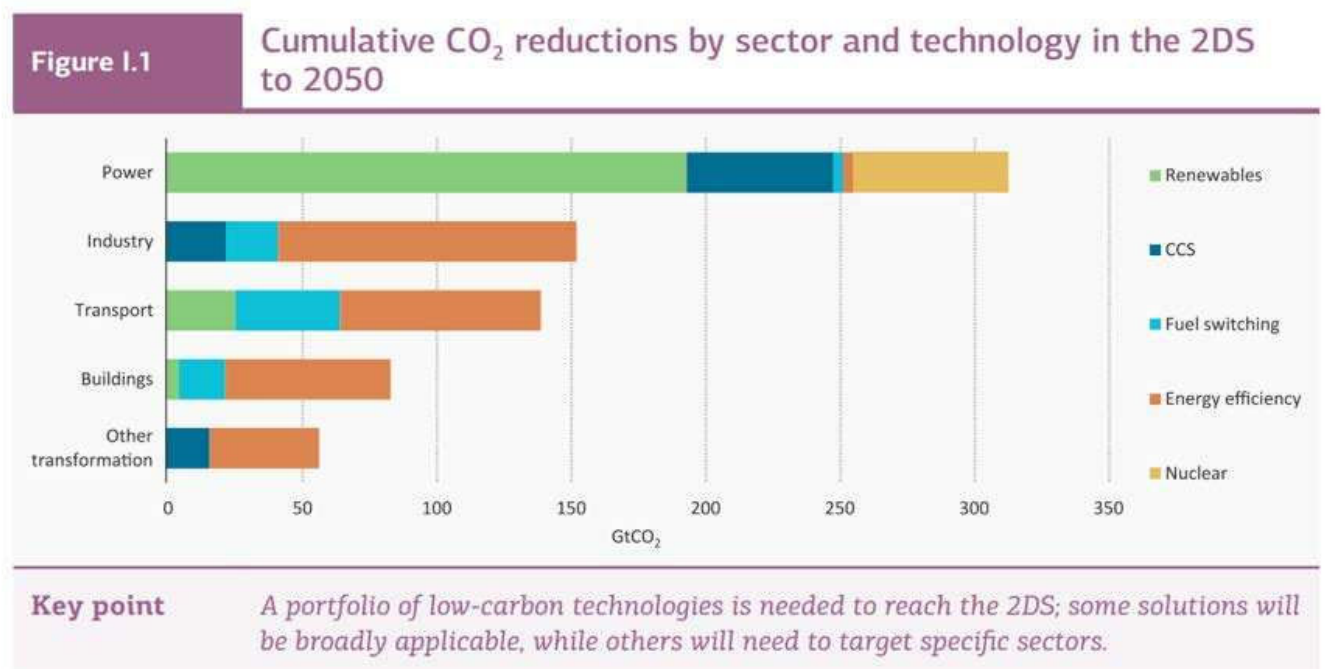
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# APPENDIX A

## GLOBAL NEED FOR CO<sub>2</sub> REDUCTIONS TO MEET TWO-DEGREE TARGET

IEA's assessment of CO<sub>2</sub> emissions reduction by key sectors and technologies.



### Potential multi-target areas

The common denominator for all these sectors are major business opportunities, a large international market and a potential for comprehensive emission reductions both nationally and internationally. To establish business activity and value creation connected to the described sectors, investments slightly higher than the “base case” requirements need to be made. However, these investments do not have to detail direct public subsidies or grants, but adjustments in public procurement and regulations that facilitate the attraction of private capital.

### Distributed energy and storage systems

Norway's geographically scattered population, beautiful nature and strong resistance towards “Monster power masts” makes the country an ideal test lab for distributed energy. According to the empirical analysis, most research on the low carbon society is actually based on the assumption of a centralized energy system like we have today. This needs to change if innovations are to be developed. Silicon solar cells perform best at low temperatures, and creating a home market for solar energy would benefit the Norwegian solar industry. Connecting this with smart grid systems, ICT products and energy storage, Norway has the potential to build an industry tai-

lored for immense global market opportunities. A financing mechanism coupled with distributed energy technology from Norway could rapidly lower financial barriers and achieve technology transfer to communities without energy access.

- Synergies with IT solutions, clean energy production, smart grid, transport.

### **EXAMPLE: BATTERY STORAGE SYSTEM BY STATKRAFT**

Energy storage is considered a main barrier for the transition to a low carbon society. With an increased mix of renewables, two things happen: Unpredictable energy supply and frequency variations. To maintain stable energy delivery, the grid needs to be balanced correctly through energy storage. Norway covers the base load with clean hydro power, so few countries have better prerequisites for experimenting with distributed energy storage coupled with renewables. This has been a major problem in Germany, which has been forced to cover the base load with coal. Bloomberg New Energy Finance estimated need for mid and long term energy storage to be 858 GW by 2040. The currently dominating technology is lithium ion batteries, but solutions such as hydrogen also hold potential.

Location: Dörverden, Niedersachsen, Germany  
Invested: 37 mill NOK for 3 MW balance capacity  
Potential market: Global and national  
Reduced GHG emissions: Globally and nationally

Source: [http://syslagronn.no/2016/05/02/syslagronn/sterkt-vekst-for-batterilagring-av-energi\\_85350/](http://syslagronn.no/2016/05/02/syslagronn/sterkt-vekst-for-batterilagring-av-energi_85350/)

oped pilot projects ready to be commercialized. Investments in the Ocean Space Centre, Norwegian Centres of Excellence and the green shipping program Grønt kystfartsprogram (GKP) are examples of major investments already made. Specific examples of project in need of large scale financing is the hybrid/ battery cargo ship developed through NCE Maritime Clean Tech, the five pilot projects developed through Grønt Kystfartsprogram.

- Synergies with: The petroleum sector, aquaculture, international trade.

### **Green shipping**

Findings indicate that Norway should electrify the shipping fleet and ferries, build on the existing competence and internationalize the industry. Significant efforts have already devel-

## ZERO MARITIME RESEARCH CENTRE

36 companies and ten research institutions constitute the research cluster of the proposed Zero Maritime Research Centre, which will develop low and zero emission maritime transport solutions. Zero Maritime applied to become one of the Research Council's research centres for renewable energy (FME) this year, but the 180 million NOK application did not get funding. There is unison consensus of the business potential and emission savings this industry cluster could provide, and the involved actors now look for other sources of funding.

The GIB could provide the capital and long term perspective necessary to realize the centre. 36 bedrifter og 10 forskningsinstitusjoner har gått sammen om initiativet Zero Maritime. An example of a concept that is part of the centre is Short Sea Pioneer:

### Short Sea Pioneer (maritime) by NCE Maritime Clean Tech

A hybrid mother cargo ship with an electric module based daughter vessel reduces the need of large ports and optimizes transport of goods at sea. The innovative solution will move a substantial amount of heavy transport off the roads and reduce emissions in the transport sector. Examples of national customers are the Norwegian towns with an export driven industry and too small ports, such as Svelgen, Førde, Kalvåg, Ullensvang, Odda, Sauda, Ålvik and Ekornes. Location: Haugesund  
Potential market: Global and national  
Reduced GHG emissions: Globally and nationally  
Economical savings for shipping firms: 15%  
Largest challenge: Financing of the pilot  
Work places: Unknown, but involves ship building and supply industries.  
Central firms: Elkem, NCL

Sources TU, Sysla Grønn

## Floating offshore wind

The immense investments required to bring down emissions in the petroleum sector could, as pointed out by DNV GL, be combined with floating offshore wind turbines. The price of electricity offshore is extremely much larger than onshore, also on the Norwegian shelf. Instead of electrifying offshore installations with land based electricity, the business policy perspective argues that floating offshore wind parks could create larger societal value, especially if connected with Norwegian green supply ships. Statoil and Statkraft have already invested in large scale offshore wind. The government's withdrawal of funds from Statkraft in 2015 ended the firm's involvement in Dudgeon, but Statoil has had the flexibility to invest further in offshore wind and has tested the business case for floating offshore wind through Hywind. To emphasize the need to be clear on system boundaries, the regulations on offshore wind in Norway has largely been performed on an energy policy basis, not an industry policy basis. Floating offshore wind is a fairly unexplored field, but Statoil has taken major steps forward to make the projects become a reality.

- Synergies with: Transition of the petroleum sector, green shipping, international technology export

## WIN-WIN: WIND POWERED WATER INJECTION BY DNV GL

Wind and petroleum engineers have modeled a system for the use of wind energy to drive water injection on the Norwegian shelf. This will lead to increased income through enhanced oil recovery, while developing and reducing the price of cutting edge renewable technologies and simultaneously cut GHG emissions.

Investment costs: 690 mill NOK, annual operation and maintenance costs 40 mill NOK

Potential work places: Substantial. Petroleum, supply vessel and wind industries

Lifetime: 20 years

Savings for oil companies: 30-40% over 20 years

Potential market: Global and national

Reduced GHG emissions: Globally and nationally

Building on already dedicated investments:

Statoil, Statkraft and DNV GL have track records in offshore wind

Source: <https://www.dnvgl.com/energy/feature-articles/win-win-wind-powered-water-injection.html>  
<http://www.tu.no/artikler/snart-kan-oljeselskapene-fa-strom-fra-flytende-havvind-kan-spare-3-dollar-fatet/34695>

## Electrification and energy efficiency

Electrification of the society could become a key to reduce emissions quickly, especially within the target sectors petroleum, transport and process industry. To tailor the society to future needs, large scale investments in smart grids, energy storage, distributed energy and necessary grid capacity are necessary. Innovations and new business models are necessary to commercialize electrification.

- Synergies with offshore wind, low emission transport, clean production, smart grid, distributed energy

## CHARGEABLE HYBRID BUSES IN OSLO, VOLVO/ SIEMENS/ RUTER

The necessary investments in public transport in Oslo and Akershus is estimated by Jernbaneverket, Ruter and Statens Vegvesen to 70-80 billion NOK (KVU Oslo-Navet, 2015)

Lifetime of buses: 10-20 years

Emission reduction, compared to 2014: 264 tonnes NOx, 1,9 tonnes PM10

Increased energy efficiency: 3-4 times

Savings over 10 years, compared to diesel: 750 million NOK

Proof of concept: Hamburg, Stockholm and Göteborg

Time frame: 51/64 bus lines are suitable for immediate electrification

Source: Best økonomi og luftkvalitet med elbuss - en studie om miljøvennlige og lønnsomme bussløsninger for Oslo (2016)

## Hydrogen production

“Hvordan kan vi subsidiere norske arbeidsplasser? Hvordan kan Norge tjene på det grønne skiftet? Vi har en prosessindustri, Hydro, Aker, Kværner og Elkem. De burde gått sammen og satset på hydrogenproduksjon” (Øystein Spetalen - C). “Instead of electrification of the trains on Nordlandsbanen, we could replace diesel with hydrogen and set up a hydrogen station in each end? It won't be electricity, but hydrogen that becomes the business that drives green jobs and value creation” (Oluf Ulseth - C).

## Low carbon process industry

Many of the great locomotives in Norwegian economy operate in the process industry. Instead of using energy abundance for export, it could be used to electrify energy intensive industry and strengthen the competitive advantage of high tech production. Cheap and renewable electricity is a major competitive advantage for Norwegian firms. In this regard, larger focus should be put on the low carbon footprint in Norwegian products. Smart clean production systems could

be developed and tailored to fit the needs of both established and new businesses.

### **EXAMPLE: SERENITY CAPITAL/ SILMAG MAGNESIUM PRODUCTION**

16 years ago, Norsk Hydro closed magnesium production at Herøya. Scottish investor Allan MacDonald wishes to reopen it. The site could potentially offer magnesium with the world's lowest carbon footprint. Comparatively, China completely dominates the world's magnesium production, with 4000 of the world's 5960 thousand tonnes (<http://minerals.usgs.gov/minerals/pubs/commodity/magnesium/mcs-2014-mgcom.pdf>).

Location: Herøya industrial park

Total costs: 4,9 billion NOK

Already committed resources: German authorities provided 3 billion NOK in loan guarantees, private investments, Enova commitment

Potential work places: 300 direct and 700 indirect

Investment needs: Loan guarantees. Has not proceeded due to lack of the last equity capital.

Potential market: Global and national

Reduced GHG emissions: Globally and nationally

- Synergies with circular economy, clean energy production, distributed energy

### **Aquaculture**

The currently second most profitable Norwegian export industry is important for value creation. Large investments have already been made to solve the environmental issues related to "lakselus", and conceptual offshore fish farms have been established. When planning new sites for fish farming, necessary research and development could be executed with green supply vessels and clean energy from floating offshore wind farms.

- Synergies with green shipping/ supply vessels, offshore wind.

### **Digitalization and IT solutions**

Norwegian citizens are known for being early adopters of new technology. Implementation of new apps, smartphone sensors, electricity monitoring devices and energy storage solutions could therefore be tested and validated rapidly before commercializing and scaling the solutions internationally. Big data analysis coupled with sensors, tracking and monitoring could provide valuable information on consumer needs and behavior. Visualization of the most sustainable choices would be a valuable opportunity to understand consumer behavior.

- Synergies with smart grids, distributed energy, new consumer behavior

### **Greening of cities**

Integrating nature in urban areas is one of the cheapest and most efficient climate mitigation measures. Abundance of vegetation in and around cities reduces the peaks of heavy rainfall, which reduces flooding due to under dimensioned wastewater treatment capacity. In addition to the health and wellbeing of citizens, greening of cities also provide natural carbon sinks and reduces the particulate matter. Greening of Regent Street, which happens to be owned by the Norwegian state through Norges Bank, is according to property manager The Crown Estate one of the first projects to be realized. The Crown Estate works "to make sure that the land and property we invest in and manage are sustainably worked, developed and enjoyed to deliver the best value over the long term" (TCE, 2016). With the new mandate of SPU to invest in property, an integrated greening and sustainability plan could perhaps be associated to the responsibility of ownership?

- Synergies with: Climate adaption, wastewater, air pollution

## EXAMPLE: THE “WILD WEST END” GREENING PLAN

State owned firms could be drivers for greening of cities in collaboration with private property owners. In the UK, an initiative called the “Wild West End” targets greening of streets, buildings and public squares through public/ private collaboration. The plan will secure climate change mitigation and adaptation in urban areas. “Although the existing parks and green-space network has functioned well for the purposes of amenity and recreation, in future it should be better planned, designed and managed to deliver a range of additional benefits, including mitigating flooding, improving air quality, cooling the urban environment and enhancing biodiversity and ecological resilience.” Mayor of London, London infrastructure plan 2050 (p 41).

Location: London, UK

Potential market: National

Reduced GHG emissions: Nationally

Source: London infrastructure plan 2050 - A consultation, Mayor of London  
The Crown Estate, <http://www.thecrownestate.co.uk/who-we-are/how-we-work/>

# APPENDIX B

*Leverage ratios vary depending on the utilized financial instrument. An example from Australia’s Clean Energy Finance Corporation (CEFC) illustrates this in figure X1, where the leverage ratio means the \$ of private sector investment for each \$1 of CEFC investment.*

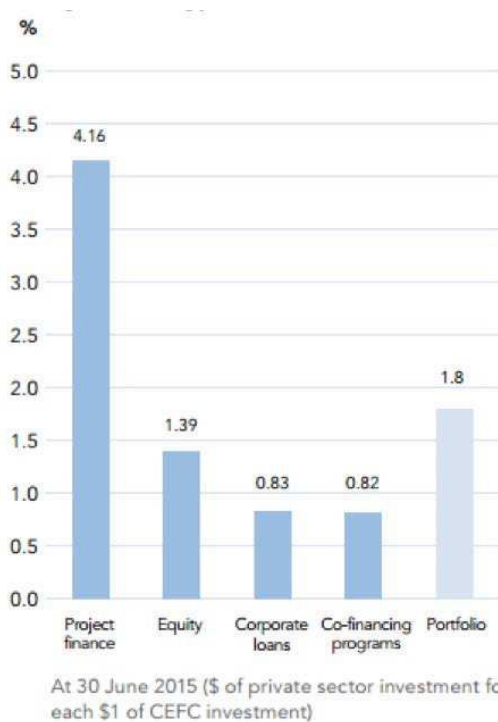


Figure A1: Leverage by finance type, exemplified by

CEFC at June 30 2015 (CEFC, 2015)

After the CGB launched leasing arrangements and loans to reduce investment costs of solar energy, there was a sharp increase in installed capacity. The amount of subsidies was drastically reduced, while the cost to consumer stabilized. Lower prices of solar panels might have impacted the results somewhat.

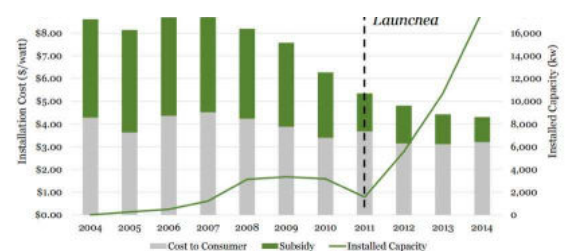


Figure A2: Connecticut Green Bank (CGB) changes grants to loans and expands the solar energy market (Coalition of Green Capital, 2015)

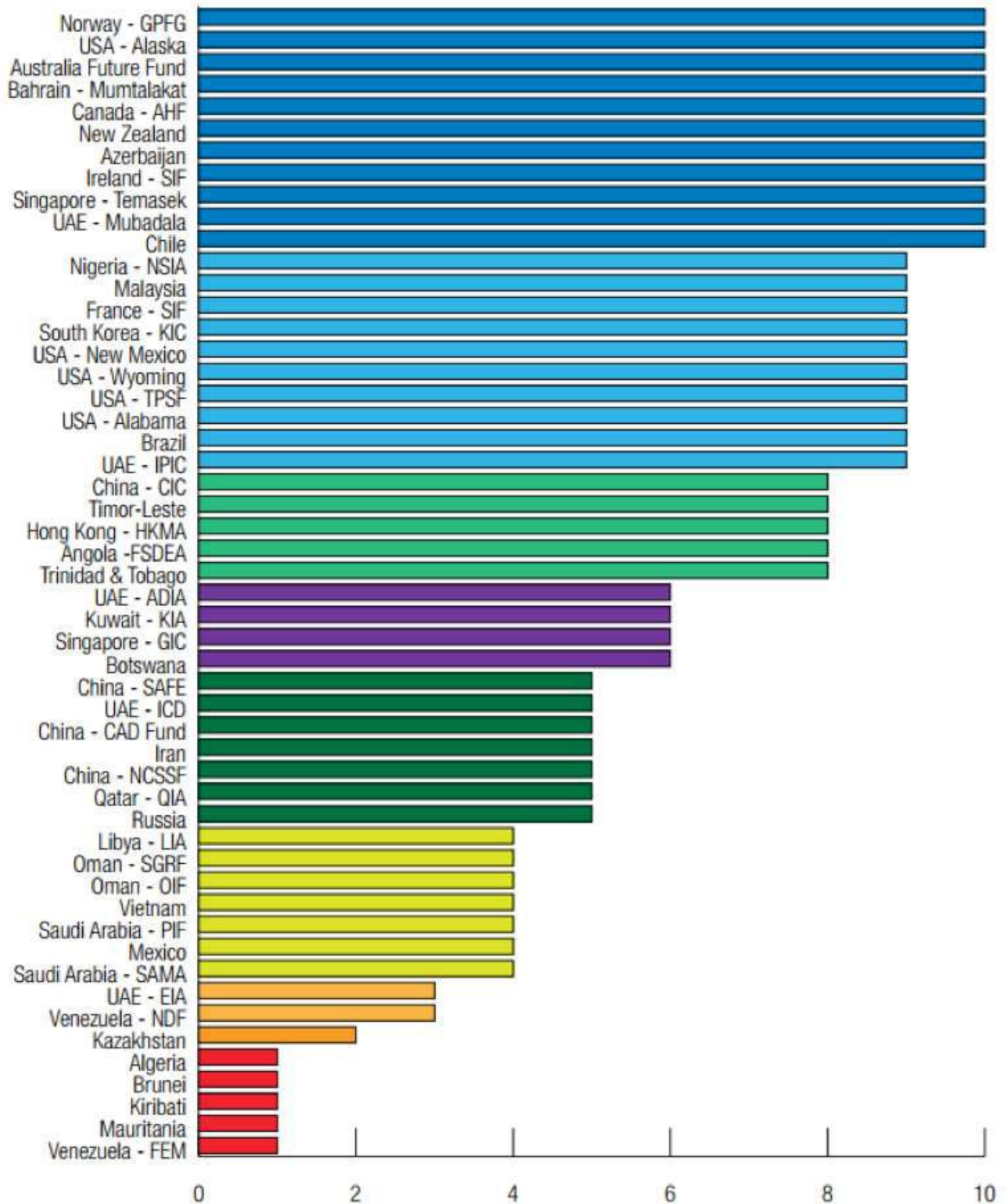
# APPENDIX C

## Proposal to expand the Transparency Index

The Norwegian Sovereign Wealth Fund rates the top score of 10 on the Linaburg-Maduell Transparency Index, the worldwide method for rating sovereign wealth fund's transparency (SWFI, 2016). The next nine largest pension funds (owned by the UAE, China, Saudi Arabia, Qatar, Singapore and Kuwait) obtain a poor average of 5.8, until the second top rated fund from Singapore is found in place 11. Transparency levels among the largest pension funds could, in other words be significantly improved. To reach the UN's Sustainable Development Goals, we suggest expanding the current Linaburg-Maduell Transparency Index to also incorporate ESG values. Pension funds hold a huge influence on the global economy, and should in principle be drivers for the wellbeing and security of future generations. By increased transparency on ESG values along with financial transparency, pension funds could contribute to finance sustainable development.

Type	Point	Principles of the Linaburg-Maduell Transparency Index
Original	+1	Fund provides history of including reason for creation, origins of wealth and government ownership structure
	+1	Fund provides up-to-date independently audited annual reports
	+1	Fund provides ownership percentage of company holdings, and geographic locations of holdings
	+1	Fund provides total portfolio market value, returns and management compensation
	+1	Fund provides guidelines in reference to ethical standards, investment policies and enforcer of guidelines
	+1	Fund provides clear strategies and objectives
	+1	If applicable, the fund clearly identifies subsidiaries and contact information
	+1	If applicable, the fund identifies external managers
	+1	Fund manages its own website
	+1	Fund provides main office location address and contact information such as telephone and fax
		Top score: 10
Proposed expansion	+1	Fund requires firms in portfolio to disclose ESG metrics
	+1	Fund discloses environmental impact of holdings
	+1	Fund discloses social impact of holdings
	+1	Fund discloses governance issues and suggested improvements
	+1	Fund requires portfolio firms to provide a Statement or Sustainable Value Matrix
		Top score: 15

The principles are originally developed by Carl Linaburg and Michael Maduell for the Sovereign Wealth Fund Institute (2016).



The LMTI transparency rating of the world's largest Sovereign Wealth Funds at 1st quarter in 2016, retrieved from the Sovereign Wealth Fund Institute (2016).



