MISSION INNOVATION | NET-ZERO COMPATIBLE INNOVATIONS INITIATIVE

COMITÉ SOLAR E INNOVACIÓN ENERGÉTICA | CORFO

>150 Megatonnes of Climate Innovations from Chile

Towards >60 Gigatonnes of potential CO_2 reductions

Introducing Chile as an "**Innovation+** Country" with innovative solutions providers with >150 million tonnes of potential

This paper presents a strategic group of innovative start-ups from Chile that has been supported by the Solar and Energy Innovation Committee, CORFO Chile. Together these start-ups have the potential to deliver more than 150 million tonnes of avoided emissions annually by 2030.

The Solar and Energy Innovation Committee, CORFO (SEIC) and Mission Innovation's Net-Zero Compatible Innovations Initiative (NCI) are collaborating to identify and support a new generation of solution providers. As the first step, a selected number of start-ups have been selected for initial estimations. In addition, earlier start-ups have been integrated using the Avoided Emissions Framework.

The goal of the collaboration is to present investment-ready innovations with a global potential to avoid more than 300 million tonnes at Mission Innovation's fifth ministerial meeting in 2020. The SEIC and the NCI, together with investors and cities, will also present a strategy for accelerated uptake of Net-Zero compatible innovations.

Innovation+

Innovation+ is an approach developed by Mission Innovation's Net-Zero Compatible Innovations Initiative (NCI) to support a shift in society from only considering reductions from polluters, to also always including their solution providers.

Currently companies, cities and countries are primarily viewed as polluters/problems where the best they can do is reduce their emissions to zero. To view companies, cities and countries as sources of emissions and only ask them to reduce their emissions is however only half of the equation.

With the fourth industrial revolution and new business models it is becoming increasingly counter-productive to only ask companies, countries and cities for reductions, as this can undermine many disruptive innovations and ignore solution providers.

The NCI provides the opportunity for stakeholders to identify solutions and assess the GHG reduction potential of these solutions.

The **Innovation+** approach allows leading companies, investors, cities and countries to develop strategies and collaborate for accelerated uptake of net-zero innovations.

To emphasise the importance of solutions the first generation of Innovation+ stakeholders must have solutions with a potential for reductions in society that are higher that their country's/ city's/ company's own emissions.

The initiative is part of Chile's concerted effort to be at the forefront of climate change mitigation by delivering transformative solutions from a new generation of start-ups, as well as established companies. These companies capitalise on opportunities provided in the current fourth industrial revolution and recognise the need for transformative system solutions to deliver what is needed for a net-zero emission future. Many of the start-ups are purpose driven and have been created in response to the global sustainability challenges of today.

Identification and assessment of innovations

In early 2019, the Solar and Energy Innovation Committee, CORFO (SEIC) initiated a collaboration with Mission Innovation's Net-Zero Innovations Initiative (NCI) to explore how the uptake of clean energy innovation can be supported.

The collaboration builds on the urgent need for curating and supporting solutions in response to the global challenge, and the ability to unleash creative energy, in combination with responsibility for present and future generations.

After an initial vetting process, assessment of the avoided emission potential was conducted on eight clean energy technology start-ups being incubated by the SEIC.

Further, keeping in view the international development agenda, particularly the eradication of poverty coupled with its commitment to following the low carbon path to progress, the links to relevant Sustainable Development Goals (SDGs) will also be assessed.

In order to provide a comprehensive assessment of solutions to ensure that they are future compatible, these solutions will, in addition to the quantification of potential avoided emissions, also be assessed in relation to their 1.5 °C pathway compatibility, how they can support net-zero acceleration and avoid high-carbon lock-in, and an innovation matrix will be used to assess how transformative the solution is.

IPCC 1.5 °C Special Report

IPCC's Special Report on Global Warming of 1.5 °C, released in October 2018 found that limiting global warming to 1.5 °C will require 'rapid and far-reaching' transitions in land, energy, industry, buildings, transport and cities.

Further, it stated that global net human-caused emissions of carbon dioxide (CO_2) would need to fall by about 45 percent from 2010 levels by 2030, reaching 'net zero' around 2050. These radical reductions require a focus on new innovative solutions that can scale fast.

In June 2019 Chile launched an ambitious national climate change agenda. Chile plans to close its 28 coal-fired power plants by 2040. It proposes to fill the resulting 40% gap in its electricity mix, plus all future growing demand, with renewable energy — with the goal of achieving carbon neutrality by 2050.

Chile also has the opportunity to play a leading role in the development of a global solar and hydrogen economy. Due to its unique opportunities Chile has been called the "solar Saudi Arabia."

Calculating Avoided Emissions

The overall concept of avoided emissions is that a solution (product or service) enables the same function to be performed with significantly less GHG emissions.

The method of measuring avoided emissions is to compare a baseline scenario without the enabling solution with a scenario using the enabling solution, where the baseline represents the 'business as usual' (BAU) scenario. This involves calculating the emissions in the following categories:

BAU system
The emissions from the BAU baseline, without the introduction of the enabling solution.

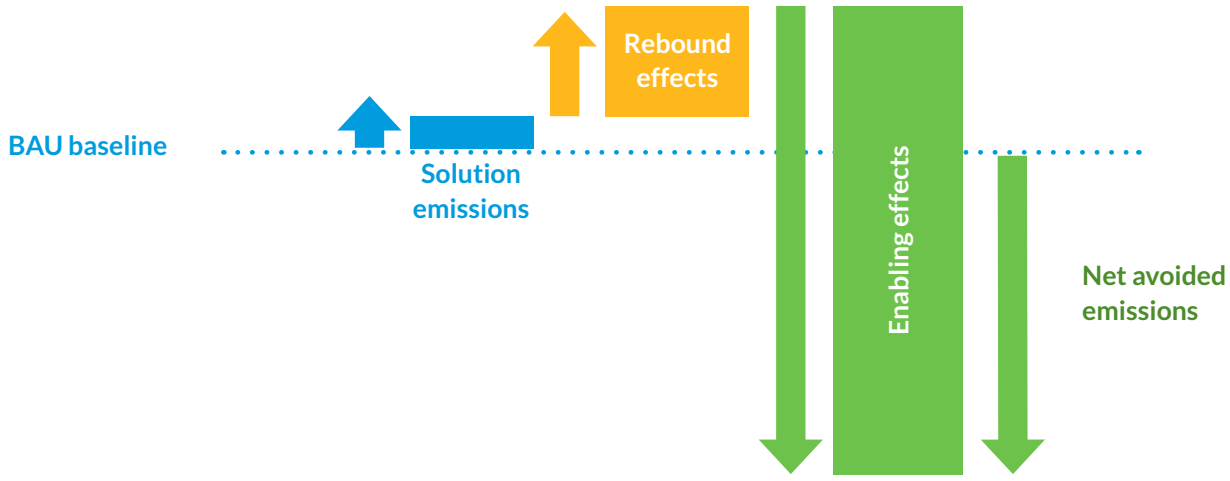
Enabling Effects
The avoided emissions due to the activities avoided as a result of using the solution. These are further subdivided into primary (or immediate) enabling effects and secondary (or longer-term) enabling effects.

Direct Solution Emissions
The life cycle emissions of the solution that is causing the enabling effect.

Rebound Effects
The increase in BAU emissions occurring as a result of the enabling solution implementation. Rebound effects may be caused by related consequential effects or by unrelated (and sometimes unintended) effects and are often related to human behavioural changes in demand for carbon-intensive goods or activities. These effects are further subdivided into immediate rebound effects and longer-term rebound effects. Because of the nature of rebound effects, they are extremely hard to quantify and predict, and assessing them is inherently uncertain as it is difficult to accurately estimate the effects.

The net avoided emissions are then calculated as follows:

Net avoided emissions = Enabling avoided emissions – Direct solution emissions – Rebound emissions



Depending on need, four levels of assessments can be conducted

AEF Level 1 assessment: A fast guesstimate of magnitude (1/10/100/1000 Mt), including what market this is relevant for (mobility, buildings, food, etc) and a short description of the solution, how it might be similar to other solutions or areas where it covers known gaps in potential.

AEF Level 2 assessment: For potentials below 50 Mt. Uses standardised calculation template. Relies on some data from the solution provider. To include some sensitivity analysis but not as extensive as Level 3.

AEF Level 3 assessment: Does not rely on any data from the solution provider (but compares with their data), uses only independent third-party verified data and compares different data sources. Level 3 is 'obligatory' when Level 2 identifies solutions >50 Mt, or when we require greater confidence.

AEF Level 4 AEF assessment: Similar to a AEF Level 3 assessment, but for a new kind of solution where new information (formulas) or deeper research are needed, or an external stakeholder wants a more thorough assessment.

Examples of Chilean Innovations

Name	Description	Avoided emissions in 2030
Solar Tracker	SolarTracker provides a web service that evaluates the performance of solar power generating systems, using an artificial intelligence engine. It provides predictive maintenance intelligence that estimates performance loses and diagnoses causes.	***30**
AtaMos-TeC	The Atacama Desert, located in northern part of Chile, has special conditions that need the development of technologies to allow an efficient solar energy generation. The solution is a new optimal solar technology to be used in the Atacama Desert.	***30**
First Solar	Conventional power plants are often used to provide ancillary services such as frequency regulation in electricity grids. First Solar have demonstrated that conventional power plants such as coal power plants can be replaced by PV power plants in the provision of frequency regulation.	**29**
Phineal, H2PV	H2PV is a business program of Phineal, which seeks to develop a business model for the generation and supply of Hydrogen obtained from photovoltaic cells.	**27**
Suncast	Suncast has a range of services for predicting and managing solar-based electricity generation, with accurate models of energy generation utilizing machine learning and artificial intelligence in combination with local weather data.	***20**
Consulting and Energy	Consulting and Energy use rice husk waste as fuel for energy production in a biomass plant that converts 20% of the fuel to ashes. Based on this ash, several products have been developed: solar grade silicon, lithium battery material, aerogels for water irrigation, a enzymatic catalyst and structural insulated panel.	***10**
Enerbosch	Enerbosh is developing small-scale concentrated solar power tower plants, with ranges from 0.5 to 3 MWe for power generation or 1 to 10 MWh for heat processes on a 24/7 basis. The heat storage medium is copper slag, a Chilean mining industry by-product, with ideal heat storage properties up to 1,000 °C.	**6**
Aiguasol	Aiguasol have designed a solar concentrator, which can be coupled to flat solar collectors or to photovoltaic modules, thereby enhancing their efficiencies and minimizing the cost of power generation. The fact that the mirrors are movable allows the structures and protective systems from wind, snow, and high temperatures to be simplified.	**1**
Phineal, Sello Sol	Sello Sol a certification developed by Phineal allows tracing the solar energy generation on its place of origin through the use of blockchain technology. The data is measured and processed to add value by using it in products, services and transactions as verifiable, transparent and secure information.	**1**
TOTAL		**>154 million tonnes ****

* Estimates of the magnitude of avoided emissions potential pending a more detailed assessment

** The estimated avoided emissions are subject to change during improvements in data sources and methodology development

A four-step approach for accelerated uptake

The Solar and Energy Innovation Committee, CORFO (SEIC) collaboration with Mission Innovation's Net-Zero Innovations Initiative (NCI) has four key elements:

Improved identification of potential solution providers

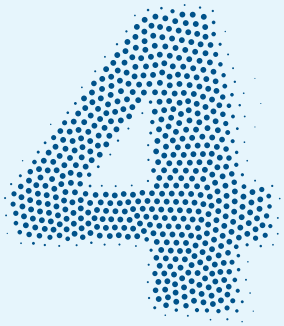
The collaboration will develop selection criteria for emission reduction/avoidance potential of start-ups to identify the most impactful solutions and enterprises. This includes both early filtering and active targeting of entrepreneurs with solutions that have a significant potential to deliver important contributions in society.

Support in early impact articulation

It has been noticed that early stage entrepreneurs struggle to articulate their impact narratives, especially with respect to their environmental contributions. The SEA and NCI will work together to support early stage entrepreneurs in identifying, quantifying and articulating potential impacts in a structured and credible manner.

Cluster encouragement

The collaboration will work to identify potential collaborating partners that can allow the solutions provided by the entrepreneur to deliver more significant results, increase the probability of success, increase market shares for the new offering, accelerate speed of innovation, etc. Collaborating in clusters increase the possibility of allowing the solutions to move beyond incremental changes in existing system to become part of a necessary transformative system change.



Strengthened links to investors and markets

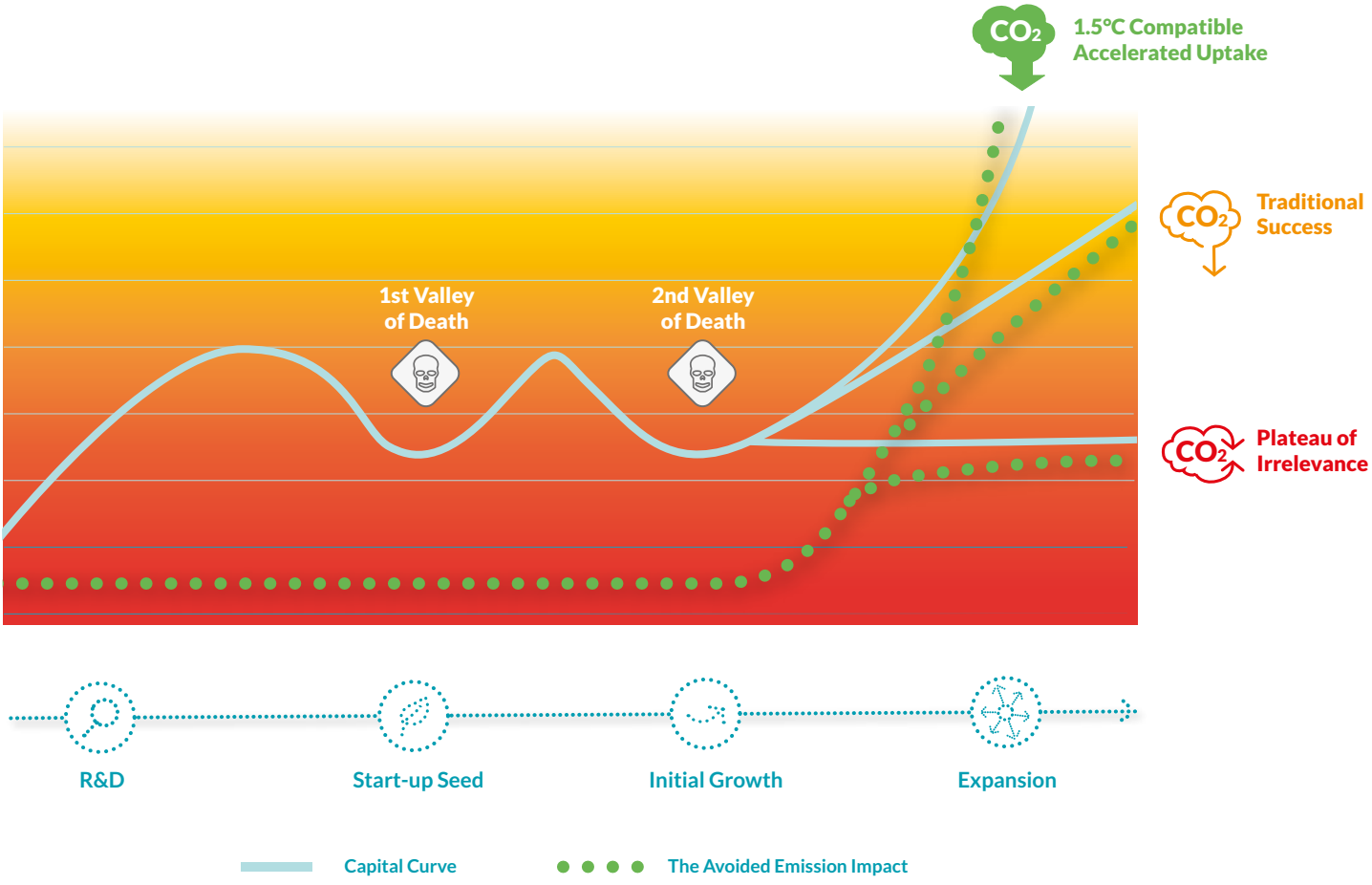
The collaboration will also explore how to best establish links between the entrepreneurs and both investors and markets. This will include the quantified assessments of the potential for avoided emissions in society and 1.5 °C compatibility assessment with SDG synergies, based on transparent assumptions and credible methodology; and connecting them to like-minded investors with an alignment of vision for emission reduction.

Next steps

The start-ups assessed so far are only a small part of Chile's start-up ecosystem and in the next phase the collaboration hopes to engage a broader ecosystem, including leading international incubators and accelerators, to gather a new generation of solution providers with a combined potential for avoided emissions above 60 gigaton of CO_2e.

This symbolic number has been selected as it is higher than the current total global emissions. By supporting Mission Innovation in gathering the largest and most significant group of solutions providers the collaboration hopes to contribute to a shift in the global climate discussions where solution providers are included in all relevant processes and initiatives.

Capital Curve and Climate Impact for accelerated uptake of Innovations



Innovation and 1.5 °C relevance curves for climate innovations

Ensuring capital and markets for net-zero compatible innovations require strategic approaches. In addition to traditional initiatives to avoid the valley of death, incentives are also needed to support accelerated uptake beyond what is traditionally seen as financially successful. Transformative system change will also require new tools to support clusters of innovations capable of delivering transformative system change. The required exponential growth of such innovations will in many cases also require low-probability high-impact investments.

Mission Innovation (MI) is a global initiative of 24 countries and the European Commission (on behalf of the European Union) working to reinvigorate and accelerate global clean energy innovation with the objective to make clean energy widely affordable. MI was announced at COP21 on November 30, 2015, as world leaders came together in Paris to commit to ambitious efforts to combat climate change.

Mission Innovation's Net-Zero Compatible Innovations Initiative (NCI) was created to help accelerate the uptake of clean energy innovations. The Initiative builds on the findings in IPCC's 1.5 °C special report, and especially the Low-Energy Demand (LED) pathway. One of the main objectives is to shift the focus from only reductions of emissions by existing big emitters, to also include support for solutions providers with the potential to deliver the solutions society needs to stay below 1.5 °C.

The Solar and Energy Innovation Committee, CORFO (SEIC), was created by the Council of the Chilean Economic Development Agency (CORFO) with the aim of taking advantage of the country solar potential from new business and energy innovations, positioning Chile worldwide in this area resource of the Atacama Desert. The Solar Committee is the government agency responsible for promoting the development of an innovation ecosystem associated with solar energy, through the design and implementation of projects, collaboration with a network of national and international actors, competitiveness, productivity, technological capabilities and markets of companies of the sector, taking advantage of the solar resource of the Atacama Desert to create a new wealth for Chile.

This collaborative work builds on important work by other stakeholders, including:

1. Criteria for 1.5 °C compatible solutions (e.g. by IPCC)
2. Identified innovation gaps (e.g. by IEA)
3. Solutions with significant reduction potential (e.g. by Project drawdown)
4. Current market preferences (e.g by cities and investors)
5. SDG synergies and status (e.g. UNDP)

For more information please contact:

Jay Hennessy
Project Leader
Mission Innovation's Net-Zero Compatible Innovations Initiative
jay.hennessy@ri.se

www.misolutionframework.net

Viviana Huerta
Project Coordinator
Solar and Energy Innovation Committee
vhuerta@corfo.cl

www.comitesolar.cl

A three-step approach for assessing low-carbon solutions

There are three main stakeholder groups that have expressed the need for a framework to assess avoided emissions, each with different reasons for wanting to do so.

1. Companies and other solution providers

Organisations with solutions that can help to reduce emissions in society – whether established corporate or disruptive start-ups – want to know the level of reductions these are providing and their potential if scaled up further. This allows them to credibly communicate their impact to customers and other important stakeholders, helping then to raise capital and sell more effectively.

2. Investors and financial institutions

Investors and financial institutions want to gain a deeper understanding of the key technologies and business models that will succeed in the low-carbon economy of the future, helping them actively pick winners rather than just avoiding losers. This is especially valuable for impact investors, or institutional investors acting with an ethical purpose, who want to maximise the positive impact of their investments.

3. National and subnational governments policymakers and regulators

National and subnational governments policymakers and regulators in national, regional and city governments want to better assess where their efforts could have the greatest effect and what further support might be required in order to scale up the solutions to climate change in the most cost-effective way.

For these different stakeholder groups there are three key benefits that can be delivered through the use of a framework that allows for the calculation of avoided emissions: to reframe their way of thinking; to reprioritize their efforts; and to accelerate the deployment of the solutions to climate change.

Reframe

Measuring avoided emissions can help to reframe an organisation's approach to tackling climate change, from a focus on the problem to the opportunity to take action.

Reprioritize

Following the process of reframing, organisations need to act on the knowledge they have gained from recognising the potential to avoid emissions. The next step, reprioritisation, is about making concrete changes to take advantage of these opportunities.

Accelerate

To avoid dangerous climate change we will need to rapidly accelerate the uptake of disruptive solutions that can deliver fast and deep reductions in emissions.

1

2

3

MISSION INNOVATION

NET-ZERO COMPATIBLE INNOVATIONS INITIATIVE

mission-innovation.net

misolutionframework.net

COP25 Version – November 2019

bwa.design

Core team and partners

RI. SE

Swedish Energy Agency

Climate-KIC

Climate-KIC is supported by the EIT, a body of the European Union

CARBON TRUST

CLEAN ENERGY INTERNATIONAL INCUBATION CENTRE

A JOINT INITIATIVE OF TATA TRUSTS

Powered by SOCIAL alpha

COMITÉ SOLAR E INNOVACIÓN ENERGÉTICA

CORFO