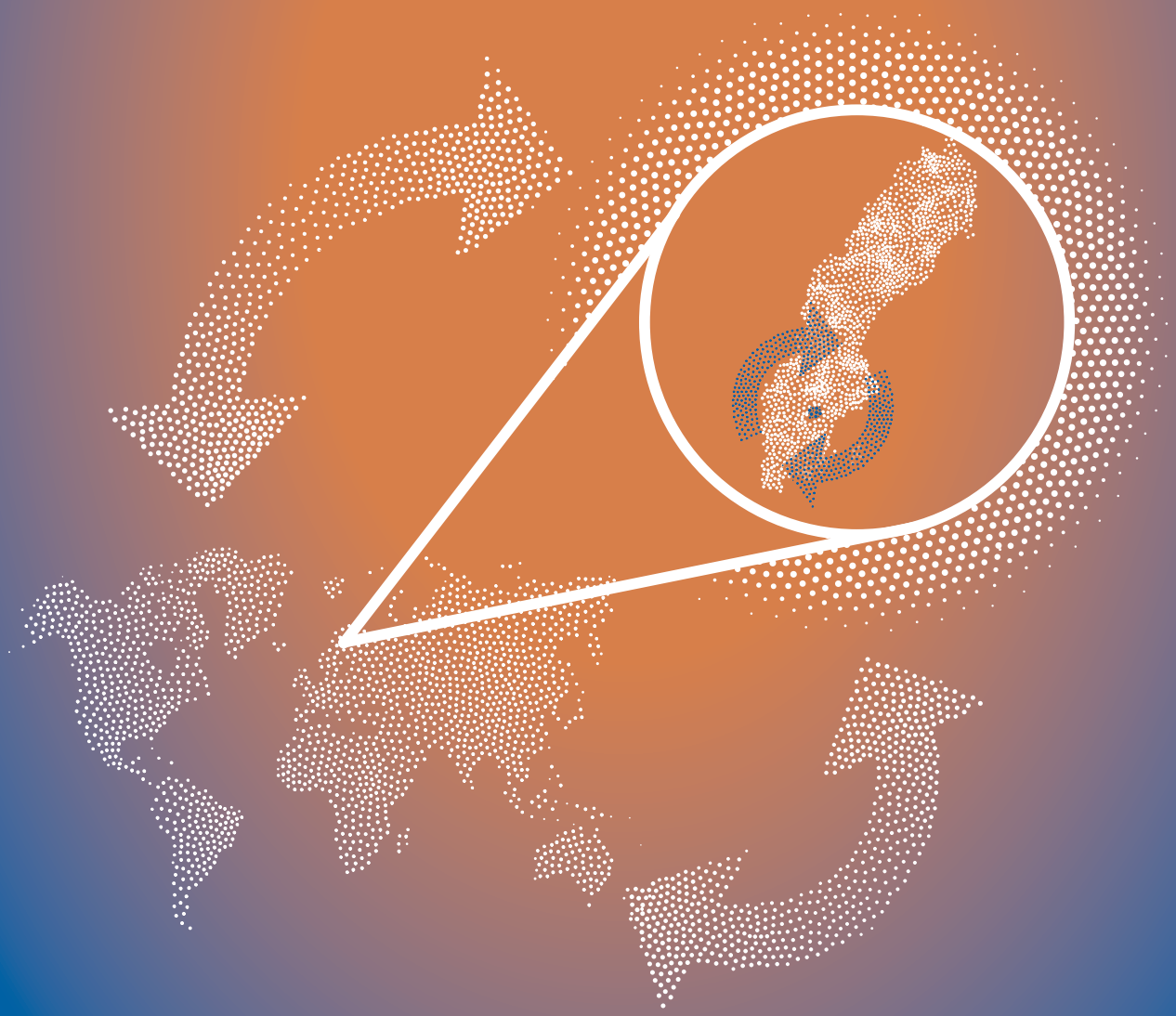
NEXT GENERATION CLIMATE LEADERSHIP

INCUBATORS ACCELERATING THE UPTAKE OF START-UPS WITH 1.5 °C COMPATIBLE SOLUTIONS

INTRODUCING THE PICU FRAMEWORK FOR INCUBATORS AND THE CASE OF LEAD ACCELERATING NEW START-UPS ANNUALLY WITH THE POTENTIAL TO AVOID >25 MILLION TONNES OF GHG EMISSIONS BY 2030.



lead CYBERCOM GROUP SWEDISH SCALEUPS EUROPEISKA UNIONEN Europeiska regionala utvecklingsfonden MISSION INNOVATION NET-ZERO COMPATIBLE INNOVATIONS INITIATIVE

V 0.9 OCTOBER 2021

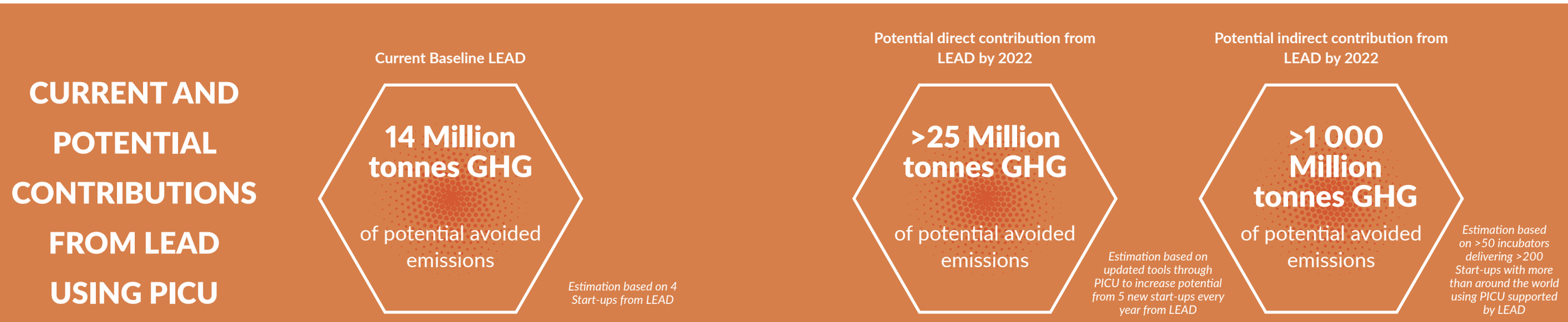
Introducing the PICU framework for incubators to deliver gigatonnes of avoided emissions though a new generation of start-ups and entrepreneurs.

The purpose of this report is to present the PICU framework and the potential for incubators to play a key role in the urgent work to deliver the deep and fast emission reductions needed to avoid dangerous climate change. PICU is a framework with four steps to help incubators, identify start-ups with significant **potential**, strengthen sustainability **ideas**, support **clustering**, and enable accelerated **uptake** of the solutions from the start-ups.

The initial group of four start-ups from LEAD, used as a case for assessment, has the combined potential to avoid 14million tonnes CO_2e annually and potentially >25 million tonnes CO_2e annually by 2030 with significant opportunities for 1.5 °C global sustainability compatibility.

To put the result in context, 14 million tonnes of avoided emissions is more than the equivalent of 25% of the current domestic emissions from Sweden (approximately 50 million tonnes[1]). With the use of the PICU framework this annual contribution from LEAD could increase to at least 25 million tonnes annually, and by disseminating the PICU framework to 50 other incubators, 200 start-ups with a combined potential of more than one gigatonne could be launched annually from incubators around the world.

It is worth emphasising that as an incubator the above numbers are the annual contributions from new start-ups each year, making incubators one of the most important stakeholders for a solution agenda when more than improvements in existing systems are possible and needed.



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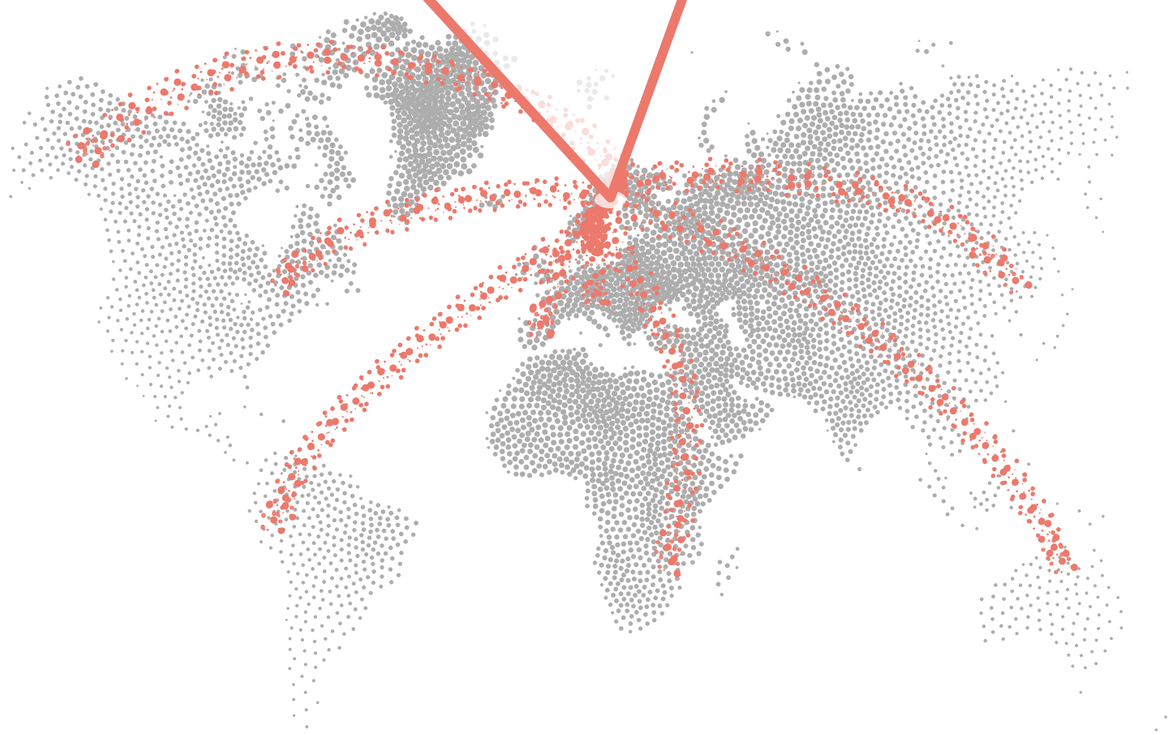
This project was funded by LEAD and Swedish Scaleups. It was carried out by LEAD and Cybercom with Julia Creutz, Digital Sustainability Advisor, Cybercom and Karin Ackerholm, Innovation Adviser, Linköping University and project leader, LEAD, as project leaders. The core project group consists of Catharina Sandberg (LEAD), Martina Hegestig (LEAD), Anders Ferntoft (LEAD), Björn Lindeberg (LEAD), Dennis Pamlin (Mission Innovation/RISE/Cybercom) and Oscar Spaak (Cybercom). An immense thank you to the core group and your contributions to the project. The project benefited from those outside the core group who participated in workshops or in other ways provided us with input and complementing views.

This paper was written by Julia Creutz and Dennis Pamlin, with valuable input from Martina Hegestig and Oscar Spaak.



INTRODUCTION

1

LEAD, in collaboration with Cybercom and supported by Mission Innovation through RISE, initiated a collaboration to explore how incubators can help accelerate start-ups with important sustainability contributions.

Incubators have a unique and important role in addressing the climate challenge. Every year they provide a new generation of start-ups with the potential to provide the solutions society needs. If LEAD, as a leading incubator, succeed in accelerating the uptake of start-ups with a high positive impact in society, they will provide the world with highly innovative solutions that for example greatly support a 1.5 °C compatible development for global sustainability.

> *This project is a step in LEADS's journey of further increasing potential for growth for all start-ups and entrepreneurs they help through incubation.*

The purpose is to establish a process for integration of a new perspective for all entrepreneurs with the ambition to increase the level of innovation, assuring long-term successful companies and to accelerate their positive impact on global sustainability. In other words, the result shall not be a separate track or program labelled 'sustainability', created for a few entrepreneurs or start-ups but an addition to their core business.

In order to identify in what ways LEAD can have a positive climate impact in society, a four-step method has been created and explored. The purpose of this method is to capture the opportunities throughout the entire incubation process. The method was applied to LEAD's overall process and integrated into a selection of tools for evaluation and business development. The method consists of four steps, or categories:

1. Identify and accelerate potential (P)

2. Refine, develop and accelerate ideas (I)

3. Encourage and accelerate clustering (C)

4. Support and accelerate uptake (U)

The method and categories above are further described in the chapter named "Introducing PICU – a four step framework".

In collaboration with RISE, LEAD have also quantified the potential impact of four start-ups in their portfolio, the results of which are described in the chapter "Current and potential impact". To be able to estimate the potential impact, the Avoided Emissions Framework has been used.

The next steps for LEAD are to test and iterate the modified tools and processes by involving more entrepreneurs and business coaches ahead. There is also a possibility to explore how more of the processes and tools they use in their daily work can be used going forward.

GLOBAL SUSTAINABILITY

2

If we continue on our current trajectory the world will be unable to deliver on the UN 2030 Agenda for Sustainable Development. Achieving the targets for goal 13 (climate) is critical in order for the world to deliver on the remaining global sustainability goals, and there is therefore a need to address this issue globally. In 2018, IPCC released a climate report where they, for the first time, presented a scenario which is based on providing innovative solutions which can transform our society and create services and products that contribute positively to society rather than only minimizing negative impact.[2] It is called the Low Energy Demand Scenario (LED) and proposes that we shift our focus from only reducing emissions to supporting innovations with potential to deliver on the societal solutions required to limit global warming to 1.5 °C. To deliver on the LED-scenario, there is a need for tech-, business model-, behavioural- and organizational innovation.

In regard to sustainability impact, different sectors and companies focus on particular areas which are important to consider in their day-to-day work. From a long-term sustainability perspective, it is important to assess the way a company contributes to overall material consumption, since it can be used as an indicator for overall sustainability. It could also provide insight to which direction the company must undertake in order to be able to provide solutions with a positive sustainable impact in support of global sustainability.

In order to establish an understanding of what kind of sustainability impact a company can contribute to, it is important to assess their value proposition. This provides insight as to how the company approaches sustainability. There are multiple definitions of sustainability, and most rankings and frameworks today use different criteria to categorize companies and their contributions. Generally, the most common view of sustainability is focused on decreasing negative impacts. Therefore, many companies that succeed in minimizing their negative impact but have a value proposition that is still inherently "unsustainable" i.e., focusing on increasing consumption, are still considered successful sustainable actors in society by the media.

There are multiple tools and frameworks for sustainability assessment available today, such as the SDG Compass[3] or the Natural Step Four System Conditions.[4] To understand what kind of society we do not want to have, it is possible to use a "doughnut approach" such as the one proposed by Kate Raworth[5], to understand both planetary and social boundaries.

These frameworks/methods cover different areas, they all have benefits and shortcomings in terms of what they cover as well as how they relate to companies. Also, most definitions of sustainability focus on the negative, a majority of frameworks today focus on describing where we should not be. These frameworks can often be used as a benchmark and to compare companies to see which are less bad in terms of e.g. cheap labour and unsustainable use of natural resources.

However, a rapidly growing number of companies, cities, incubators, etc. are looking for an approach which aligns with a 1.5 °C for global sustainability, including a Half-Earth future[6], with the kind of smart and resource efficient development path as IPCC outlined in their Low-Energy-Demand (LED)/P1 pathway. Approaching such a vision enables companies to ask fundamental questions about their business model and possible solutions for a positive transformation, shifting from comparing themselves to other unsustainable companies.

Mission Innovation and UNFCCC have called such an approach a dynamic solution approach.[7] This approach focuses on solution providers and human needs, rather than sources of emissions and current sectors and is part of an expanded climate innovation space (see illustration below).

Dyllick and Muff[8] present a categorization of business sustainability that aligns with a growing understanding of the need for innovative and transformative solutions. These categories support the view that global sustainability requires more than incremental improvements in existing systems and focus on societal needs and how a company can provide relevant solutions. BCG is an example of a leading consultant with a climate opportunity approach.[9]

Ideas from the start-up and innovation ecosystem have huge potential to contribute to avoided emissions and to provide solutions needed for a LED-scenario future.

> *"To ensure start-ups have a significant impact a new generation of incubators must evolve and be able to identify, develop and accelerate ideas and entrepreneurs in a way that increases the uptake of important solutions."*

A successful incubator must be able to support their entrepreneurs and idea owners through the entire innovation and business development process in order to accelerate each start-up's potential. Not all solutions will be significant by themselves, but by enabling clustering most will be able to contribute to something positive. By having a structured strategy in place to support all companies and not only those with a self-explanatory significant impact, leading incubators could accelerate the uptake of 1.5 °C compatible solutions in society.

Incubators are a part of a great innovation ecosystem which involves multiple actors that affect start-ups and entrepreneurs from the start of an idea to expanding their business, markets and investors. A few examples of such actors in Sweden are universities, science parks, Swedish Scaleups[10] and Ignite Sweden.[11] By extending already existing collaborations as well as initiating new ones with both national and international actors to cover identification and acceleration of start-ups and entrepreneurs with high sustainability impact potential, LEAD would be able to significantly increase the effects of this work.

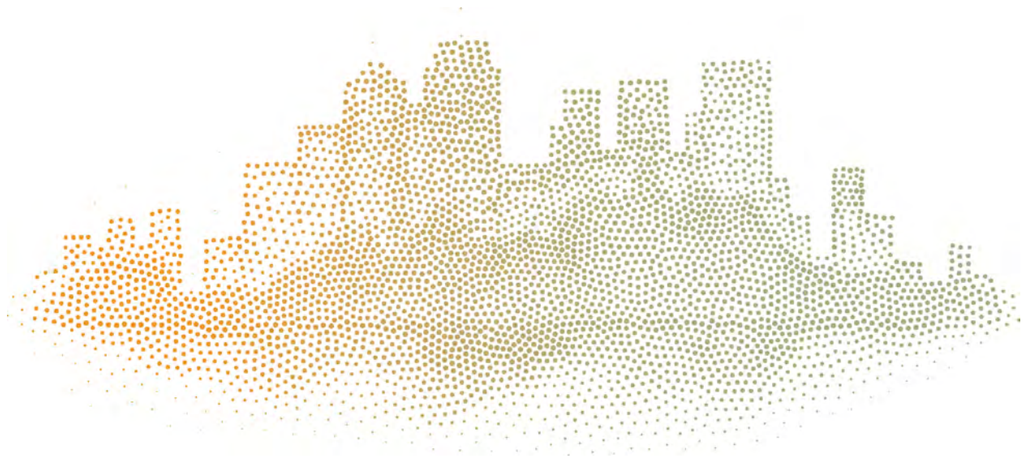
LEAD AS A LEADING INCUBATOR IN A LEADING CITY

3

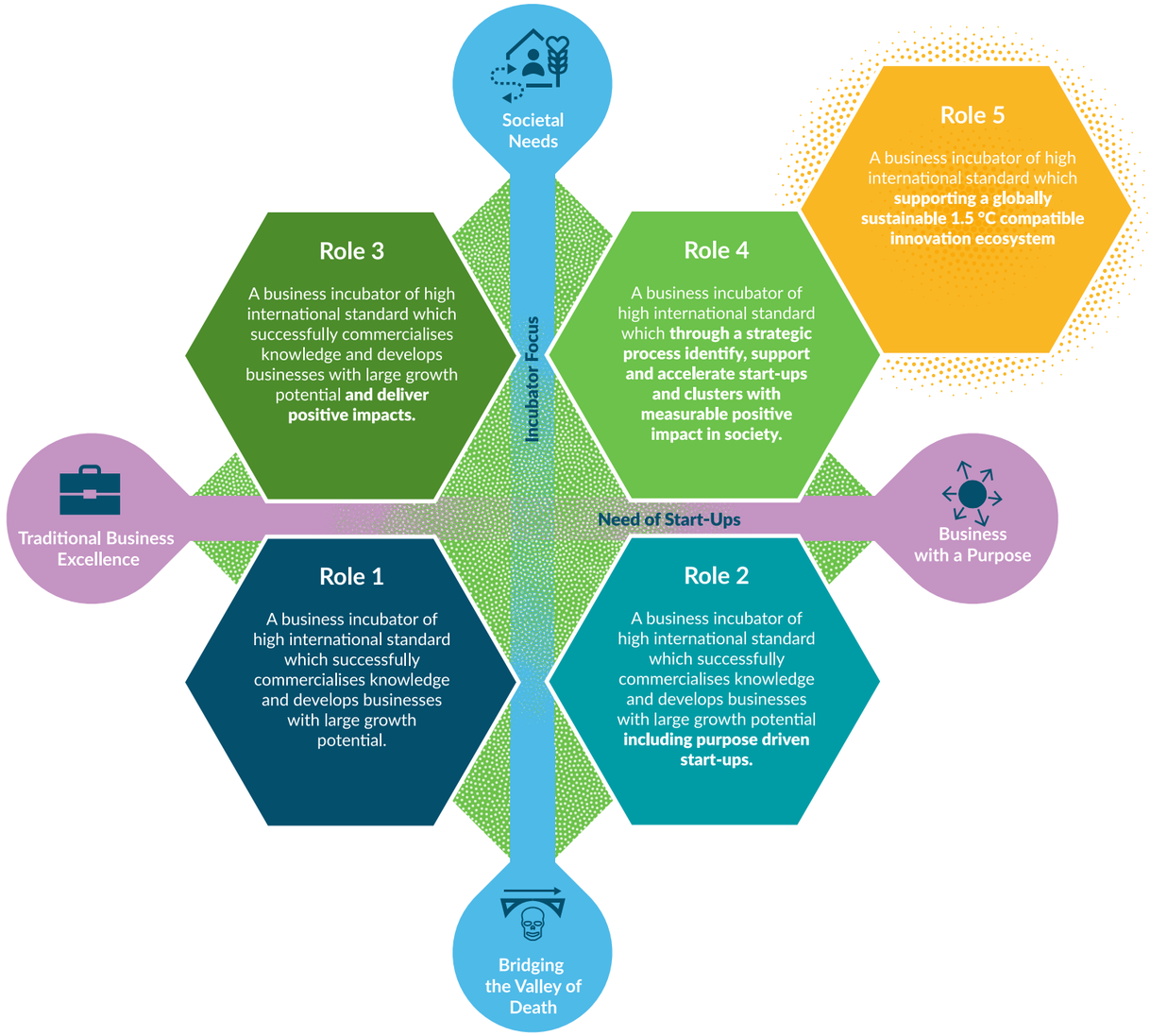
As is the purpose of most incubators, LEAD is focused on growth and the economic sustainability of the start-ups they support through their programme. However, LEAD recognize that in order to be relevant market players in the future the entrepreneurs need to realize their ideas' potential impact so as to achieve increased possibility of uptake and positive contribution.

According to research, the survival rate of start-ups are around ten percent. Numbers from LEAD presented in 2020 show that almost 73% of the start-ups that have gone through their incubation program are still active.[12] In other words, LEAD has a great opportunity to deliver significant contributions to sustainability through the entrepreneurs they support. The choice of adapting this new perspective is also strengthened by the fact that LEAD is located in Linköping; a municipality in Sweden that have set the goal to live within the planetary boundaries and to be carbon neutral in 2025.[13]

To explore LEAD's possibilities going forward, four feasible value propositions which would position LEAD in various scenarios have been reviewed. These scenarios should be viewed as guiding benchmarks and it is possible to fulfil some criteria in multiple scenarios at a given moment. They represent shifts that incubators are confronted with and illustrate a journey with more than one stop and plenty of opportunities as well as challenges.



ROLES FOR INCUBATORS IN THE 21ST CENTURY



The first great shift between these scenarios is presented on the Y-axis, which represents moving from business as usual for most incubators to actively setting goals for maximizing their positive sustainability impact. The second shift suggest a change from traditional business excellence to purpose driven business, which essentially require the incubator to consciously and in a structured way accelerate positive impact. The scenarios are described further below. The roles are not mutually exclusive, and most incubators have multiple roles.

ROLES EXPLAINED

Role 1

This role describes a business-as-usual perspective. In this role, an incubator uses established tools and processes which help deliver results for growth and business potential. There is a possibility for positive sustainability impact, but it is unintentional and is not measured or communicated internally nor externally.

Role 2

The second scenario involves a shift from traditional business excellence to purpose driven business. This adds to the business-as-usual scenario in a way that more consciously takes care of purpose driven entrepreneurs. This often means more structurally supporting those who are already purpose driven, not necessarily encouraging all entrepreneurs to comply to the approach.

Role 3

The third scenario represents a shift to more deliberately assessing the potential sustainability impact that the start-ups/ideas might have. The incubator quantifies and communicate the results but is not actively accelerating the estimated potential.

Two ongoing projects that are examples of contributions according to this scenario is the "Towards >60 Gigatonnes of potential CO_2 reductions" in Chile and India.[14]

Role 4

This shift is in line with the LED-scenario and is consciously and strategically identifying, supporting and accelerating the positive impact their solutions might have. A structured method for the above is established and practiced. This scenario requires an innovation ecosystem which encourages solution providers as well as accelerates uptake and clustering in collaboration with incubators.

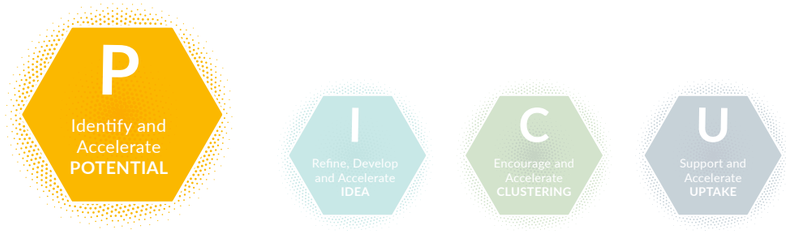
Role 5

This role is different as it moves outside the current role of an incubator in the existing innovation ecosystem and engages in work to shape the next generation of innovation ecosystem. With the unique insights into the next generation of solution providers leading incubators have the potential to play a key role as the innovation ecosystem of the 21st century is created.

INTRODUCING PICU — A FOUR-STEP FRAMEWORK

In order to explore possible options for LEAD to have a significant net positive impact in society, this project has focused on a framework whose purpose is to capture the opportunities throughout the entire incubation process. By ensuring that sustainability will be an integral part of their core business, incubators can create an environment which enable them not only to identify ideas with a potentially significant impact but also to actively support the start-ups throughout the whole business development process. The framework consists of four categories:

With the purpose of exploring different strategies within these categories the framework (PICU) was mapped according to LEAD's overall process. This showed that the categories can be used in various parts of this process and bring a specific value depending on when and how they are used. Below, each category is introduced step by step; a general introduction and explanation of the category, what is relevant to discuss, and how each category has been explored or assessed in this project.



P: Identify and Accelerate Potential

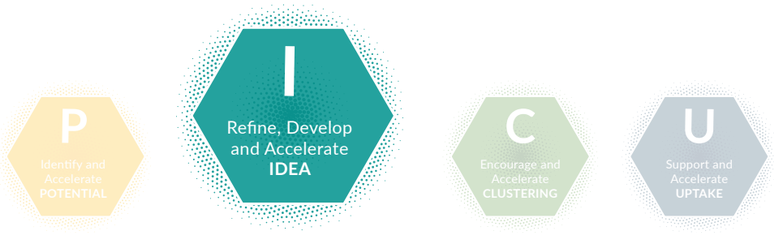
The first part of this category is to assess the potential impact LEAD can have through the start-ups they help evolve. The potential can be assessed during various stages in the process. LEAD could identify which societal needs should be addressed and create calls that aim to capture ideas that could have an impact in those areas. This is a way for incubators to filter ideas at a very early stage. It is also possible to quantify the potential of an idea an incubator is presented with, assess companies already involved in their process and/or keep track of the companies that are successful after their involvement with the incubator.

To make an assessment of the current potential of a start-up, it is necessary to determine what need the start-up is addressing and what order of magnitude the positive contribution could be. Furthermore, it is important to explore if the start-up is purpose driven, if they are solution providers and if their technology and business model is incremental, disruptive or transformative.

In collaboration with RISE, LEAD have quantified the potential impact of four start-ups in their portfolio, the results of which are described in the chapter "Current and potential impact". To be able to assess the potential impact, Mission Innovation's Avoided Emissions Framework and 1.5 °C compatibility assessments has been used.[15] Aside from identifying and assessing, LEAD need to help the start-ups articulate their potential impact narratives in a structured and credible manner.

The second part of this category is about accelerating potential. When it becomes clear what potential impact a start-up could have, it is possible to either stop there or actively work to accelerate that potential impact. This can be done by asking the right questions at the right time, use the tools and knowledge available and ensure that this way of working becomes an integral part of the start-ups' business.

To enable acceleration of an idea, it is crucial to explore what needs a start-up could address and how the positive contribution could increase by identifying areas where the entrepreneurs can provide significant contributions to society. Additionally, it is important to address the results of the assessment conducted in the first part and depending on the outcome explore how to shift from a problem focused perspective to providing solutions, as well as determine current prerequisites and future possibilities of the technology and business model.



I: Refine, Develop and Accelerate Ideas

To ensure that an idea not only has a hypothetical potential contribution but also has market impact, incubators can support start-ups by helping them refine and develop their ideas through business development. There are several established tools and processes available for business development, and by applying a new perspective to these tools and processes an incubator can accelerate the entrepreneurs' ideas and increase the possibility of reaching their potential impact.

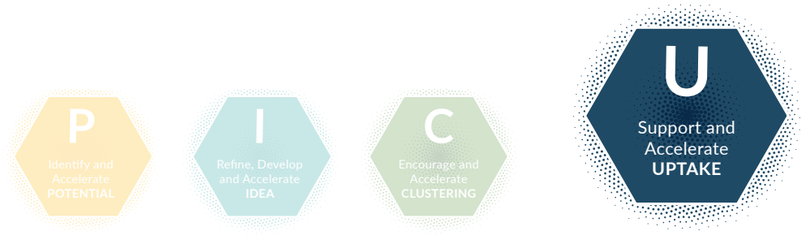
To manage the above, it is essential to explore how to increase the positive contribution and define the societal need. A start-ups' business model has to support both the societal and user/consumer need and should support everything as a service (XAAS)[16] when applicable. Moreover, the potential of the technical solution being transformative, the possibility to include sustainable and renewable energy, and the possible trajectory for enabling a globally sustainable scenario for the idea should be assessed.

This category is where leading incubators can really increase their impact through the start-ups they support. They usually already have resources (tools, processes, people) in place with which they are able to advise the entrepreneurs about how to grow their ideas and create a basis for healthy and successful companies. The intent with the PICU framework is to integrate it into incubators' already well-established processes and tools.

C: Encourage and Accelerate Clustering

By identifying potential collaborating partners, both other start-ups and relevant investors, the probability of success and uptake of the potential impact of the entrepreneurs' solutions increase significantly. Clustering and collaborating in ecosystems increase the possibility of solutions to move beyond incremental changes in existing systems to become part of a necessary transformative system change.

To strengthen delivery and impact of transformative solutions, it is necessary to regard disruptive trends as well as identifying important investors and potential partners. This is true not only for the start-ups incubators support, but also for incubators themselves. Including new investors or developing already existing relationships with current investors and partners/collaborators will increase the incubators reach and positive contributions.



U: Support and Accelerate Uptake

What happens to the start-ups after their involvement with the incubator? In this category, questions about uptake, success rate and actual impact are raised. It is important to assess what works and what does not, as well as how far from the purpose the actual result is. Uptake is reliant on the previous steps being thoroughly assessed. To increase the probability of uptake it is important that the start-up has market potential and relevant investors.

To support and accelerate uptake incubators have the possibility of involving collaborating partners, in Sweden this would include science parks, Swedish scaleup, Ignite, Linköping municipality as well as international actors.

INTEGRATING PICU IN LEAD'S CORE BUSINESS

The purpose of this project is to realize the start-ups' potential and create an environment where they actively work to accelerate that potential together. This is something that differentiates LEAD from many other incubators who work with sustainability. Many mainly focus on the "P"-category, while LEAD is aiming to accelerate potential through the I, C and U categories as well. Establishing a strategy that includes and covers several sustainability areas and still focuses on deep-tech capacity and transformative solutions is truly unique.

During the incubation program it is possible for LEAD, together with the entrepreneurs to explore opportunities for increasing their potential impact by using either climate specific tools or modified versions of business development tools such as Business Model Canvas (BMC) or SRI value proposition as "need", "approach", "benefits" and "competition" (NABC)[17] and alike. LEAD currently have a strategy in place for a materiality analysis that they carry out together with the start-ups, which is based on the UN global development goals. Through tools and processes like these, LEAD can support the entrepreneurs to create a value proposition which can lead to new potential markets connected to increased sustainability impact.

During this project, the different categories of PICU has been mapped to an overall incubation process as well as LEAD's own process (for internal use). The method has also been integrated into a selection of tools for evaluation and business development that LEAD use in their day-to-day work, for example BMC and NABC. The purpose of these modifications is to enable the business coaches to assess and accelerate the start-ups' potential impact. The suggested modifications are not the final result but need to be tested and iterated by LEAD to reach their full potential.

CURRENT AND POTENTIAL IMPACT

As part of the project four start-ups were selected and their climate impact was assessed by an international team of leading experts, coordinated by RISE. Below is a summary of the assessments.*

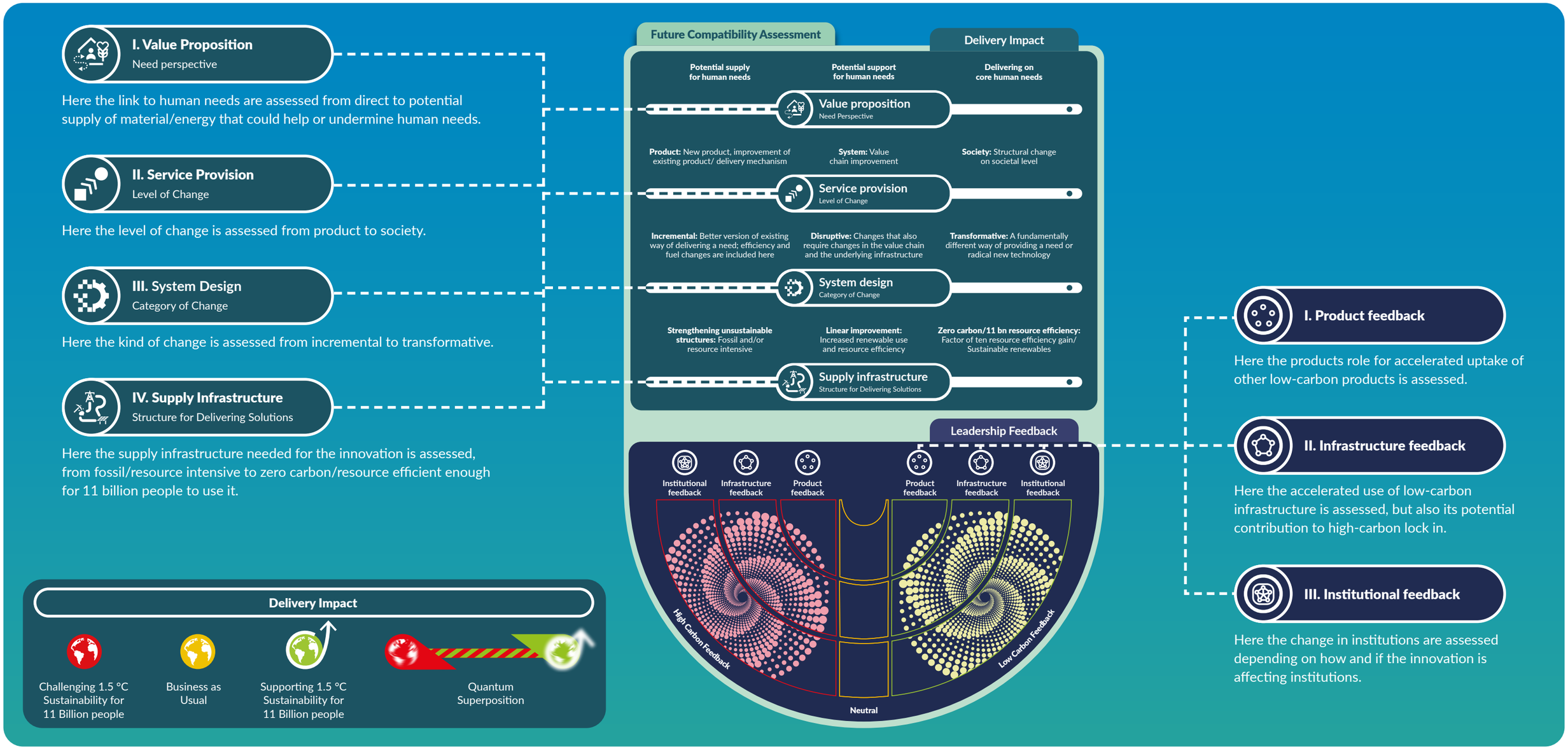
* One of the start-ups did not want to share the results from the assessment

The avoided emissions calculations for the start-ups are based on the Mission Innovations "Avoided Emissions Framework"[18] where a dual LCA approach is used, i.e. where the avoided emissions with the innovation from the start-ups are compared with a business as usual scenario. The future compatibility assessment for the start-ups are based on the Mission Innovations "21st Century Climate Innovation Assessment".[19] This includes one part where the delivery and impact of the start-up is assessed in four areas outlined on the left below.

In the second part, leadership and feedback systems are assessed. The way innovations feedback systems function is critical for the exponential speed and transformative system change needed. These systems are assessed in three areas as outlined on the right below.

The rating of the different assessment criteria above uses a traffic light system to assess the innovation's future compatibility in six areas. Green being supportive, yellow for neutral, and red undermining for each of the areas.

In addition to these three traditional assessment criteria the assessment framework also includes a "quantum" category. This category captures the complexity in the fourth industrial revolution and is also meant to highlight the need for system assessments beyond individual innovations and companies.



Freja - Crop farming assistant

Provider: **AgriOpt AB**

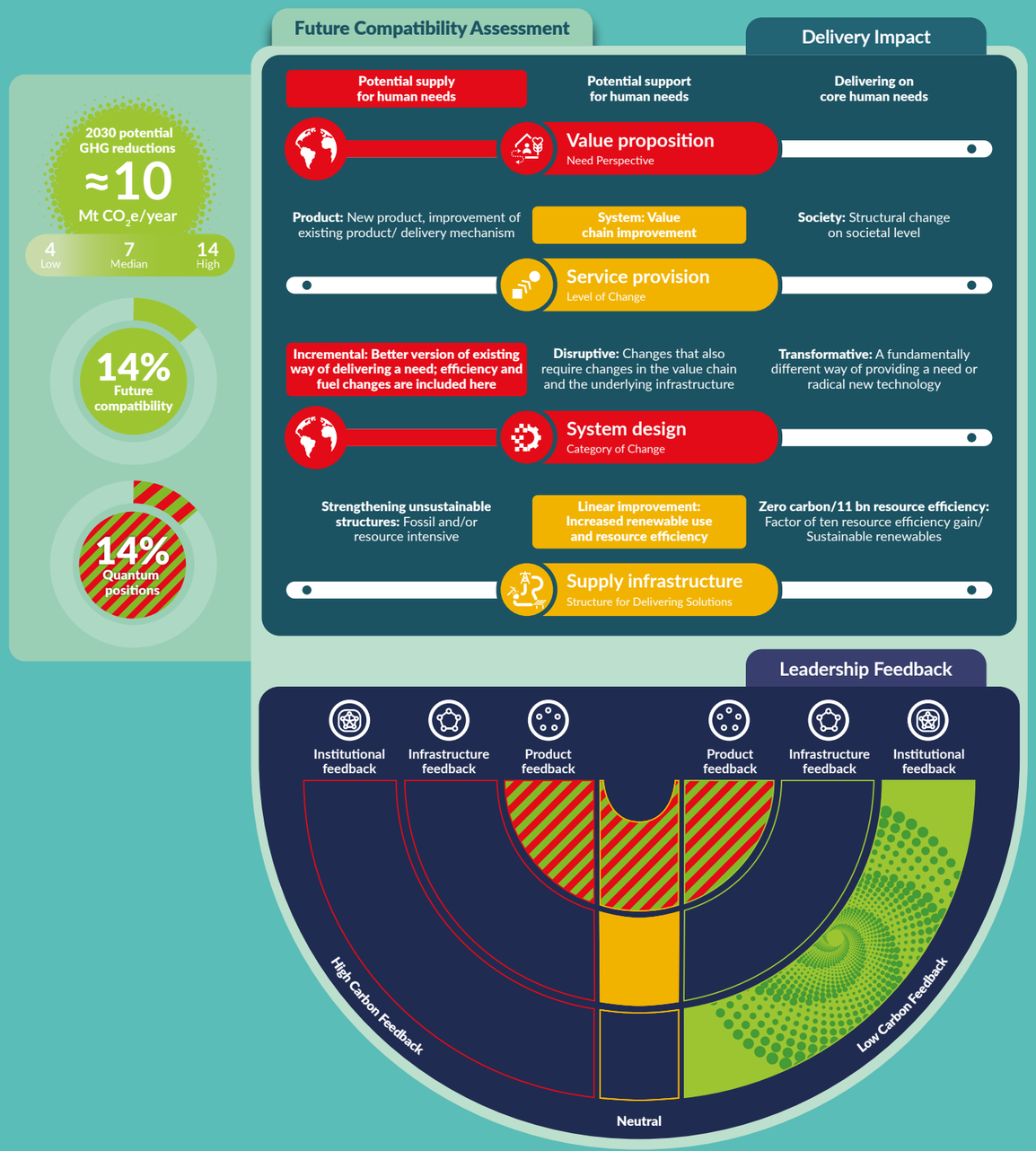
Country: **Sweden**

Freja collects and analyses important crop farming data to produce field specific information on agricultural inputs, which can be used by a farmer to improve fertilisation techniques. The improved techniques typically increase crop yields, without the overuse of fertiliser. The reduced use of fertiliser, in turn, contributes to significant avoided carbon emissions.

The innovation is estimated to decrease the use of nitrogen fertiliser by 27%, which will reduce carbon emissions globally. By enabling precision cultivation, the innovation allows the right amount of fertiliser to be added in the right place at the right time. It differs to conventional cultivation, where the same amount of fertiliser is spread regardless of the variations in soil.

Based on global estimates of fertiliser production, expected reduction in fertiliser use, and prognosed market uptake the avoided carbon emissions are estimated as 7 $MtCO_2e$/year in 2030, assuming 5% of the fertisier market.

A simplified sensitivity analysis gives potential lower and upper values of 4 $MtCO_2e$/year and 14 $MtCO_2e$/year.



Forest based stationary energy storage

Provider: **Ligna Energy AB**

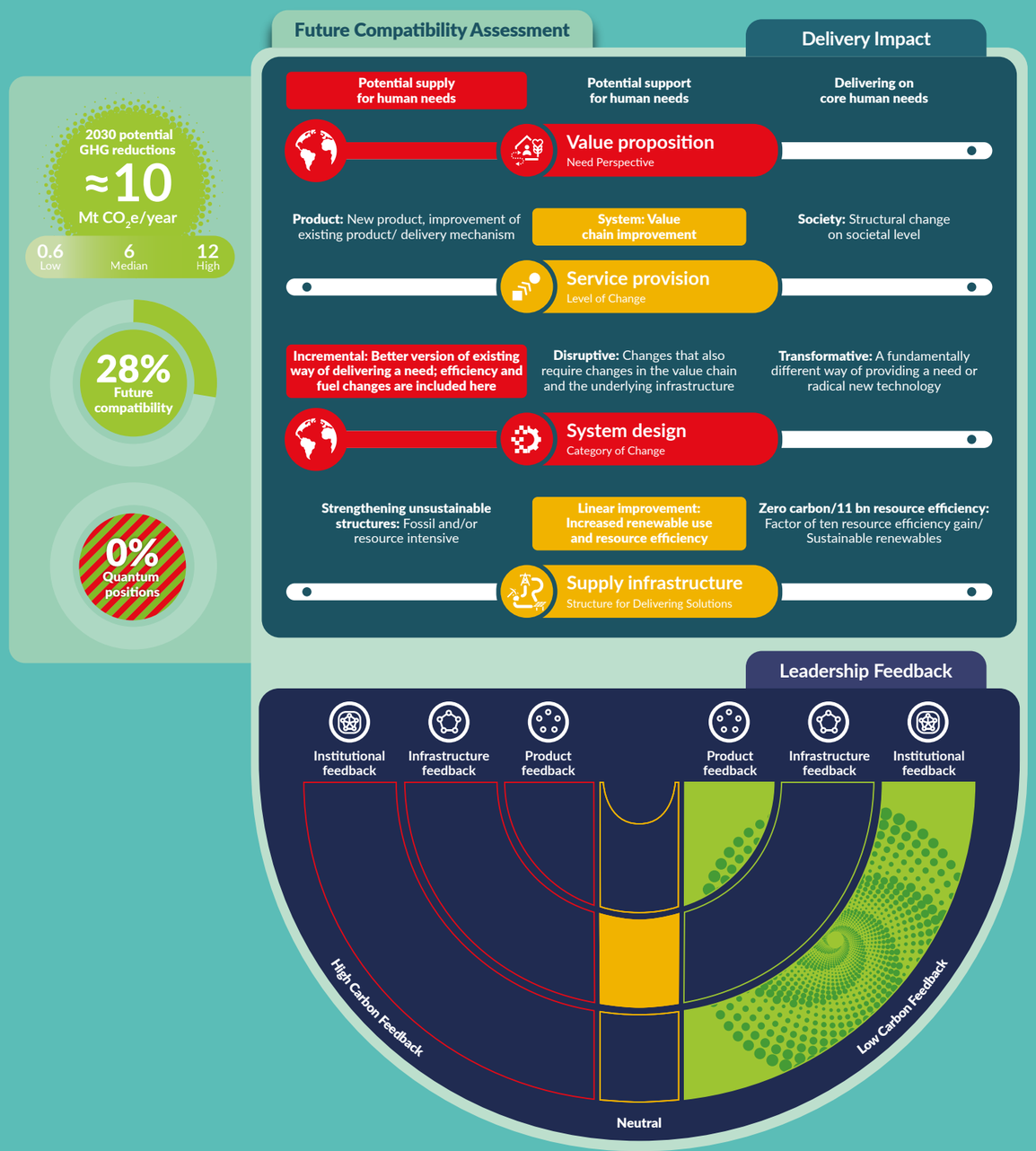
Country: **Sweden**

Forest-based materials to produce battery storage capable of storing and dispatching energy to the electrical grid at scale. Additionally, with sustainable material used for production (and the opportunity to recycle and utilise biomass energy at end of life) the innovation has substantially less embodied carbon than competing solutions such as Lithium Ion (Li-Ion) batteries. The batteries are capable of an energy density of 40 Wh/kg and a cycling capability of 5 000 cycles with 80% depth of discharge.

Organic electronic polymers and biopolymers sourced from forestry materials have been established as effective materials for the manufacture of batteries for electrical storage. The batteries are capable of an energy density of 40 Wh/kg and a cycling capability of 5 000 cycles with 80% depth of discharge. The market for the innovation is focused on larger scale stationary energy storage due to the lower energy density compared to battery solutions such as Li-Ion. The need for cost effective energy storage is well established for grid frequency control and storage of excess renewable energy as well as to balance demand side loads such as for electric vehicle charging and to facilitate more effective use of small-scale renewables.

Considering both the market opportunity for the innovation (or similar stationary storage solutions) to increase global grid energy storage capacity and the reduced embodied carbon the avoided carbon emissions are estimated as 6 $MtCO_2e$/ year in 2030, based on a market-share of 10%. The technology is also applicable to small scale applications that could become increasingly relevant under a 1.5 °C sustainable pathway.

A simplified sensitivity analysis gives potential lower and upper values of 0.6 $MtCO_2e$/ year and 12 $MtCO_2e$/year.



Ultra-thin Moisture Sensors

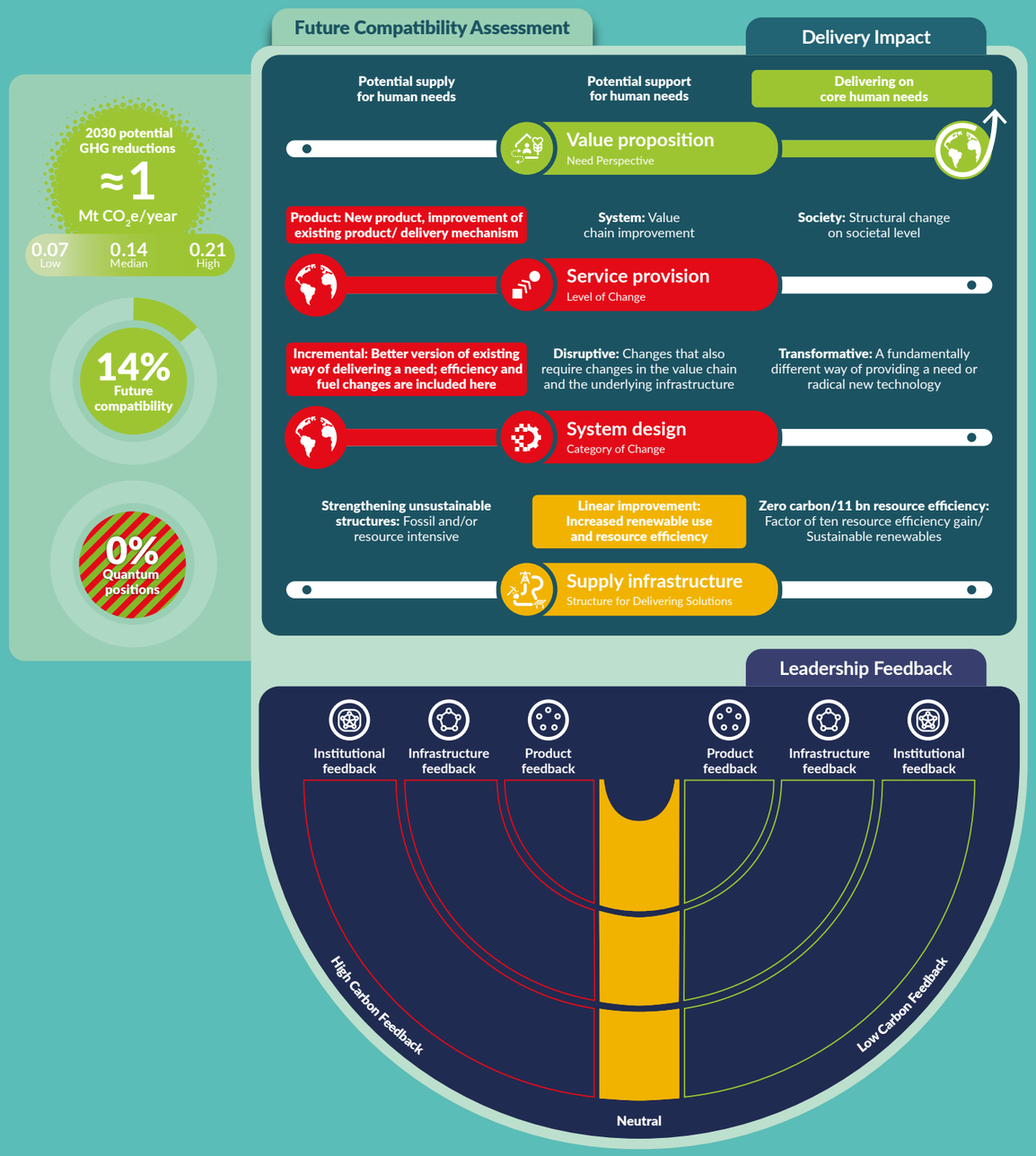
Provider:
InviSense AB

Country:
Sweden

The innovation enables early detection of water-provoked damage in wet rooms, bathrooms and other areas where concealed water pipework is used. As a result, the innovation enables more targeted repairs, compared to the present cases, hence avoiding unnecessary work and use of materials, and subsequently, associated carbon emissions.

In the UK, the average cost of each claim for damage caused by water leaks is 3 600 GBP, and the average number of claims is 246 389 per year. This equates to 0.83% of households making claims each year. Assuming Ultra-Thin Moisture Sensors (UTMS) are installed in 6.5% of homes in relevant markets globally, or 36 million homes, a benefit for up to 301 146 homes per year could be expected. The early detection of the problem in these homes will lead to fewer and smaller (the leakage is detected earlier) repairs, resulting in a total avoided carbon emissions of 0.14 $MtCO_2e$/year in 2030 based on the assumption of only 6.5% installation rate and only repairs due to leakage in households only. In addition to households all commercial usage such as monitoring of flat roofs, reduction of re-work in the construction process, reduction of repairs due to built in moisture problems during construction, etc. can be added.

A simplified sensitivity analysis gave potential lower and upper values of the avoided carbon emissions of 0.07 $MtCO_2e$/year and 0.21 $MtCO_2e$/year.



POTENTIAL NEXT STEPS

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Below are some suggested steps forward and the expected outcome:

INTERNAL

P – Identify and Accelerate **POTENTIAL**

1. Special calls with deep-tech climate potential.
2. Quick scanning of start-ups to identify significant potential.

I – Refine, Develop and Accelerate **IDEA**

1. Implementation of the revised tools.
2. Revision of all remaining existing tools.
3. Addition of new tools where necessary.

C – Encourage and Accelerate **CLUSTERING**

1. Climate Impact clustering workshops to support increased uptake.

U – Support and Accelerate **UPTAKE**

1. Joint initiative with local business angels to support start-ups with >30 million tonnes of potential per year.

EXPECTED RESULTS

1. 14 Million tonnes per year 2030 Baseline delivered every year
2. Improvement over baseline due to PICU
3. Total potential contribution = Annual contribution to 2030 per year x years (10)

EXTERNAL

P – Identify and Accelerate **POTENTIAL**

1. Arrange a Climathon with Linköping University, EIT Climate KIC and interested stakeholders.

I – Refine, Develop and Accelerate **IDEA**

1. Swedish incubator initiative for start-ups with 50 Megatonnes potential.
2. UNFCCC/Mission Innovation initiative for international API for climate solutions.
3. Collaboration with world leading incubation tool developers to ensure climate solution support in existing tools.

C – Encourage and Accelerate **CLUSTERING**

1. International cluster initiative under the UNFCCC.

U – Support and Accelerate **UPTAKE**

1. Initiative with Net-Zero Alliance with call for investment in start-ups with significant and/or strategic climate potential.
2. EU collaboration to deliver solutions for 100 Net-Zero cities with network of international incubators.

EXPECTED RESULTS

LEAD Impact x Number of Incubators x degree of similarity

Goal: 20 incubators in Sweden, 100 international by 2022

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