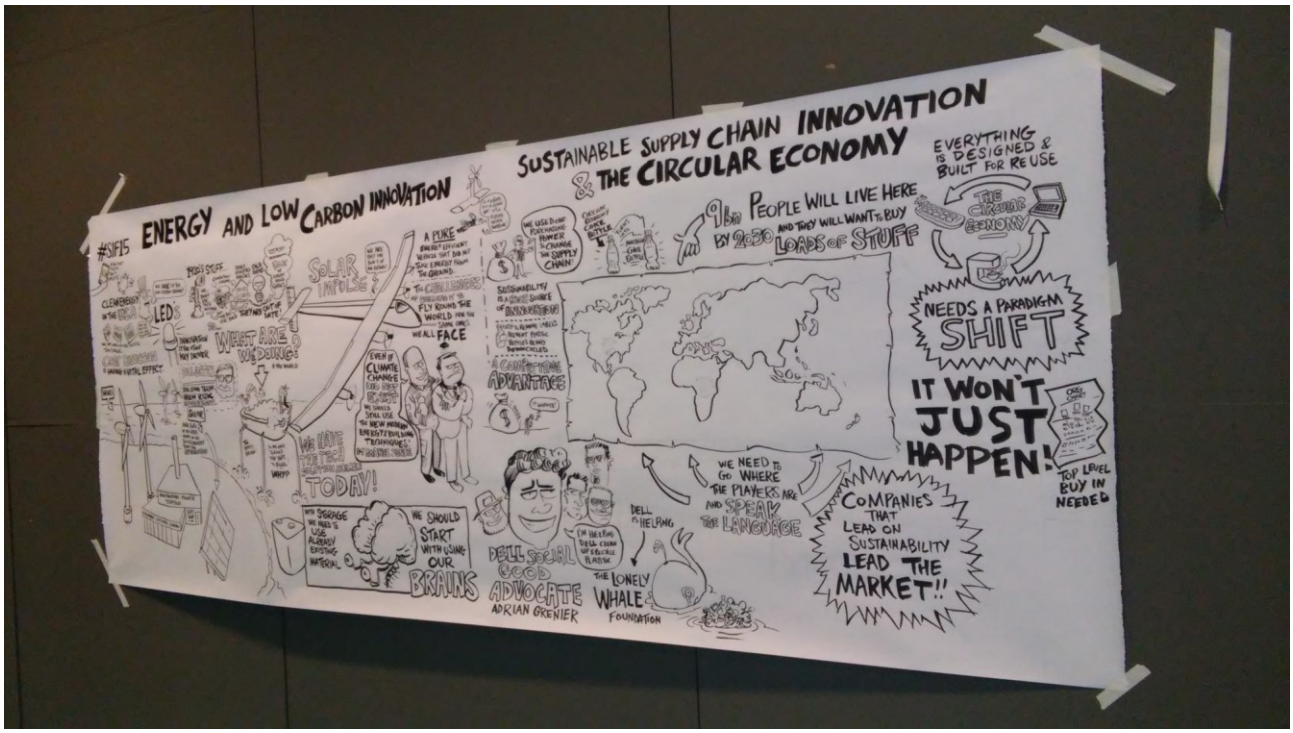
# Global Carbon Data Cloud Technology

## Facilitating Emissions Reduction



# Introduction

## Purpose

The objectives of the program are:

1. To reduce atmospheric CO2e by facilitating carbon market trading with activities that can be assessed, approved and potentially certified for tCO2e savings, for example replacing fossil carbon with renewable energy generators in electricity micro grids, afforestation, replenishment of marine environments, removal of plastic waste from oceans
2. Encouragement of new activities for community projects for abatement of greenhouse gas emissions for example regeneration of mangroves, prevention of deforestation of old growth forests
3. To publish current and establish new accredited carbon emissions reduction methodologies easily accessible to local communities and commercial projects anywhere in the world.
4. To provide emissions abatement projects assessments and compliance monitoring online by credible organisations with a climate change engagement.
5. To facilitate governments, NGOs and corporations to buy community carbon offsets and sell their own offsets into carbon markets

An associated benefit is anticipated to be input into global carbon pricing by providing data and analytics about carbon emissions reduction projects, markets, prices and data.

The key enabling strategy is to sign up governments, NGOs and corporations seeking access online to research, information and data about greenhouse gas emissions. The platform is to provide a cognitive search facility to published climate change research and reports, as well as structured data (emissions calculation methodologies, carbon pricing algorithms and carbon emissions factors). In fact, any data associated with carbon savings.

## Program Overview

The program aims to link local emissions reduction projects with organisations that can provide stewardship to establish credible, verifiable estimates of greenhouse gas emissions reduction potential.

A cloud computing platform is the enabling capability to facilitate

- Linking organisations, projects and customers
- Search for climate change information
- Calculation and measuring greenhouse gas emissions reductions

Initially tCO2e emissions reduction (tonnes of CO2 equivalent in terms of Global Warming Potential) projects can be encouraged where compliance is easy to achieve. Project carbon offsets, for example from replacing fossil fuels with renewable energy, can be validated and sold directly through carbon traders to carbon markets.

Energy efficiency, low carbon building, agricultural carbon sequestration and other activities that are not currently covered by any methodologies can also be encouraged and facilitated. Project development service providers can develop/validate new emissions reduction methodologies and guide projects through the certification process. Certified carbon offsets can be traded once validated. In the meantime, projects assessed as eligible where there is no current methodology can

still apply for funding until the methodology achieves accreditation (when project offsets can be certified and sold).

Project applications are made through a simple online process. Assessment status is updated by steward organisations that assess project eligibility. Finance can be sought based on the future value of carbon offsets. These offsets are to be offered to online buyers in a new carbon credits marketplace.

Projects apply for funding via corporate and community online applications. Projects are connected with service providers with appropriate expertise for the project category. Assessments are made either with current methodologies published online, or by the development of new methodologies, paid for by commercial customers or through community project finance.

Climate change organisations, academia, governments and NGOs can be invited to develop, monitor, publish, share, peer review emissions reduction methodologies. After verification, these methodologies can be submitted for accreditation.

Project development services provide identification and application of carbon emissions tracking methodologies. Monitoring, interaction with and accreditation of projects is on a fee for service basis.

The cloud platform also provides a point of collection and aggregation of local carbon emissions monitoring data and research. Longer term, this may provide data to confirm the accuracy of carbon emissions reduction and carbon pricing mechanisms currently in use. (Standardization of carbon emissions data is to become increasingly important over the next five years, as countries seek to meet stated targets for emissions reductions pledged at the UN COP21 Paris conference to address climate change.)

Information collected from the projects can be shared publicly by geolocation, as well as aggregated to dashboard infographics. This provides an innovative platform for sharing data as well as anecdotal information about community emissions reduction projects.

## Project Stakeholders

The following are the three main stakeholder groups.

1. Commercial customers e.g. governments, corporations pay for emissions reduction project development, and connections to carbon offset certification and carbon traders and markets.

2. Organisations with expertise in emissions reduction provide project development services, facilitating the certification of projects, and providing validation for certification with e.g. the Gold Standard, Verified Carbon Standard and United Nations CDM.

3. Community projects can promote their emissions reductions projects to obtain seed funding, to obtain carbon savings estimates, and to obtain certification for activities not previously sanctioned under any certification scheme can be achieved by offering future carbon credits to subscribers via an online market.

Governments, corporations and communities seeking web access to information about climate change, carbon emissions monitoring and pricing and/or engaging in emissions reduction projects can access the cloud computing platform by subscription.

Organisations with carbon emissions monitoring expertise are invited to foster project development for certification, monitoring and publishing methodologies for calculating greenhouse gas emissions.

Public information is also to be made accessible, including provision of simple emissions reduction dashboards on an industry basis.

Community projects are provided with as much technical, program and financial assistance as possible.

# Summary of Proposal

## Objectives

There is a recognised need to enable as many effective and genuine carbon emissions reduction initiatives as possible for countries to meet Paris Agreement climate change targets.

There is a recognised ambition to improve the accuracy of emissions reduction calculations to monitor progress towards Paris Agreement emissions reduction targets.

Enabling governments, corporations and communities to engage in local projects to provide real emissions reductions within the local context requires:

1. Guidance and stewardship to develop projects, both commercial and community, with overall effectiveness in reducing emissions over time, without causing unintended consequences such as raising indirect emissions, or causing environmental damage.
2. Monitoring projects to ensure that tCO2e abatement estimates/calculations are as accurate as possible, easy to access, and inexpensive.
3. Connecting projects with organisations to provide validated estimates of the emissions reductions quickly and efficiently
4. Publication of new emissions abatement methodologies for peer review and endorsement by organisations to validate practices as well as certification standards.
5. Facilitation of community emissions reduction projects by providing ready access to finance based on the projected value of the carbon offsets produced over the project lifecycle.
6. A public cloud platform for offering and selling community carbon offsets to governments, NGOs and corporations.
7. Online project monitoring approvals based on manual and automated policy settings and risk estimates, engaging credible organisations with appropriate knowledge and experience in the compliance processes.

## Subscriber Knowledge Base

The platform offers subscribers access to a contextual climate change and carbon emissions global knowledge base from all published climate change and emissions reduction data provides guidance, information and precedents for project engagement

The search technology provides

- A terms searchable index and linked content via guided cognitive taxonomic and text search

Notifications and topic-based interaction provides

- Connection amongst organisations for subscription, publication and sharing knowledge and information via a cloud hosted publication/media application

Access to the cloud platform is offered to commercial customers such as governments and corporations seeking to reduce emissions on a paid subscription basis.

The platform also publishes project data. For commercial organisations, data is securely pseudonymised and anonymised for statistical aggregation. A condition of community project engagement is cloud platform publication of project data for the benefit of other organisations.

## Role of Project Monitoring Organisations

Credible organisations with expertise in greenhouse gas emissions monitoring are engaged as service providers for project assessments, development, monitoring and stewardship to carbon offset certification.

Monitoring of project development, methodology publication and peer review of carbon emissions calculations and algorithms used to estimate tCO2e savings are expected to result in improvements in accuracy.

Many organisations already hold extensive information about climate change projects and methods for carbon emissions reduction.

Application of new methodologies could be facilitated by collaboration amongst organisations with expertise on project carbon offset validation.  Over time this is anticipated to improve the accuracy and efficacy of determining project eligibility.

## Marketing and PR

Marketing campaigns are conducted through climate change PR organisations with a global reach, such as Climate Home, a UN sanctioned organisation providing outreach and PR to the UNFCCC climate change conferences.

Targeted campaigns can sign up

1. Governments and corporations required to report on climate change and offset greenhouse gas emissions to UNFCCC annually for paid subscriptions
2. Organisations as paid service providers to offer expertise to assess, monitor emissions reduction and guide projects.

The paid subscriptions provide access to cognitive searchable knowledge base of climate change research and data.  This information is made accessible using cognitive search techniques and technologies to attract interest in the Global Carbon Data Cloud.

## Cloud Technology

Climate change knows no borders.  This initiative is to connect emissions reduction projects anywhere in the world to project development, carbon offset certification and carbon markets. It is intended to apply to community projects as well large commercial initiatives.

Carbon markets have been stagnating for some time, with low prices for carbon offsets, and uncertain value for buyers.  This project aims to regenerate interest in the following ways

1. Offer a cognitive searchable climate change knowledge base as in incentive to sign up customers

2. Connect government and corporate customers to project development and carbon offset certification
3. Where time and money for Voluntary Emissions Reduction certificates are community project inhibitors, the following services are to be offered:
    a. Provide an online market for carbon offsets from community projects assessed as eligible, for sale to customers
    b. Provide connection to financial institutions offering low cost loans with future carbon offsets as security.

Information technology on public integrated cloud platforms to provide cost-effective online approvals process workflows for

1. Initial assessment of project eligibility, and recommendations for project development
2. Connection to and monitoring of project development, including calculation of carbon offsets
3. Marketing of community emissions reduction projects to buyers of carbon credits
4. Peer review and publication of new methodologies by credible climate change organisations

Organisations with appropriate climate change/greenhouse gas emissions knowledge to engage in initial assessments and ongoing monitoring of projects emissions certification.

Organisations that develop new and update emissions reduction methods to use the cloud platform for peer review and publication.

Publication of existing standard algorithms and methodologies to estimate emissions reduction results in improvement by exposure to scrutiny.

## Project Finance

Engagement of credible organisations for project validation provides a reasonable degree of certainty in the accuracy of project tCO2e carbon emissions reduction estimates over the funding lifecycle. Linkages are made with carbon certification organisations such as Carbon Fund and Gold Standard for validation.

Innovative projects currently have little chance of finance or accreditation. Certification is currently slow, expensive, and nowhere near widespread enough to achieve Paris Agreement targets in time to prevent catastrophic warming and sea level rises. Markets have an invariable history of investment in projects with a successful track record (this accounts for why it is possible to gain certification for wind power and prevention of methane landfill, but little else).

A major goal is to speed up the process of obtaining finance by applying preliminary carbon emissions reduction calculations to community projects, and offering the carbon offsets for sale online, prior to methodology verification and offset certification.  Marketing of community projects is intended either to sell the offsets as future carbon credits, or help projects to low cost green finance.

The challenge is to achieve sufficient credibility and popularity for community carbon market offerings.

# Program Financials

## Solution Design and Development

The solution is to provide technology services incrementally, on cloud hosted infrastructure that can be extended flexibly to suit the business climate and demand for services and scaled up (or down) to meet changing business needs.

Data is accessed in production on high speed cloud computing infrastructure comprising containerised virtualised servers, networks and storage. (Virtualisation is the ability to configure information to add storage, hardware, and software to the processing capability provided by the data centre).

**Table 1 - Summary of Proposal**

| Project Name – Global Carbon Data Cloud Program<br>Total Cost: £1. 3M<br>Funding Required: £225,000<br>Solution Lifespan - 5 years | | |
|---|---|---|
| Strengths | Weaknesses | Recommendation |
| Able to start small with low-cost and grow on demand by using cloud technology<br>Carbon credits and offsets are supported by Paris Agreement<br>Early in carbon offsets market<br>Governments and corporations are looking for carbon emissions related data and information<br>May be a strong market for supply of carbon emissions abatement calculations and algorithms | No credibility in carbon marketplace<br>Uncertain carbon pricing<br>New market with an uncertain level of demand<br>No history of community awareness for climate change projects<br>Current carbon emissions monitoring is manual estimation | Seek support sponsorship from organisations interested in climate change project financing<br>Attract government and corporate customers with infographics, dashboards and international climate change and carbon emissions knowledge base<br>Start with projects that provide low hanging fruit (already well understood emissions reduction methodologies and calculations).<br>Conduct intensive targeted marketing and PR campaigns |

**Table 2 – Solution Outline**

| Solution Outline | |
|---|---|
| Services | Description |
| Marketing to organisations | Promotion by Climate Home, a leading source of news and analysis on climate change politics to the UNFCCC. |
| Computing, design and web information access services | Classification of structured and unstructured data, web registration, access, publication and |

| | |
|---|---|
| | subscription services |
| Cloud Infrastructure services | Scalable cloud hosting and network services. Development and testing services |
| Data integration services | Interfaces to and collection of emissions metrics, emissions analytics and infographics, emissions algorithm calculations. Carbon pricing integration with carbon trading platforms |

**Table 3 – Solution Analysis**

| Requirement | Solution |
|---|---|
| Benefits | Ability to develop an accessible climate change knowledge base provided by relevant international organisations. The knowledge base is to serve as the basis for globally networking projects, science and finance to address carbon emissions reduction. |
| Total costs (over 5 years) | £1. 3M – as this is a cloud-based project, these are operational costs |
| Approximate annual development costs | Average annual costs £250,000 (includes ongoing development of new technology components) Maintenance costs are anticipated to be around £50,000 per annum |
| Implementation timeframe | 2019-2023 |
| Fit to Requirements | The use of cloud hosted ICT and IIOT technology is a timely cost-effective measure to encourage sharing of information and data about carbon emissions reductions |
| Implementation risk | Risk mitigation is to constantly review the services to be provided by the program to understand the level of engagement by countries addressing climate change to warrant a global cloud hosted development. Depending on subscriber interest raised by exposure at COP22 in Morocco, links to carbon emissions calculators and algorithms can either go ahead, or the program can stop at this point, recouping investment through access to the knowledge base alone. |
| Conclusion | The Knowledge Base and web access provides a global government and corporate subscriber base addressing an international requirement to monitor the reduction of carbon emissions. Funding for Phase 2 (real-time carbon emissions) can be raised from subscriptions revenue. |

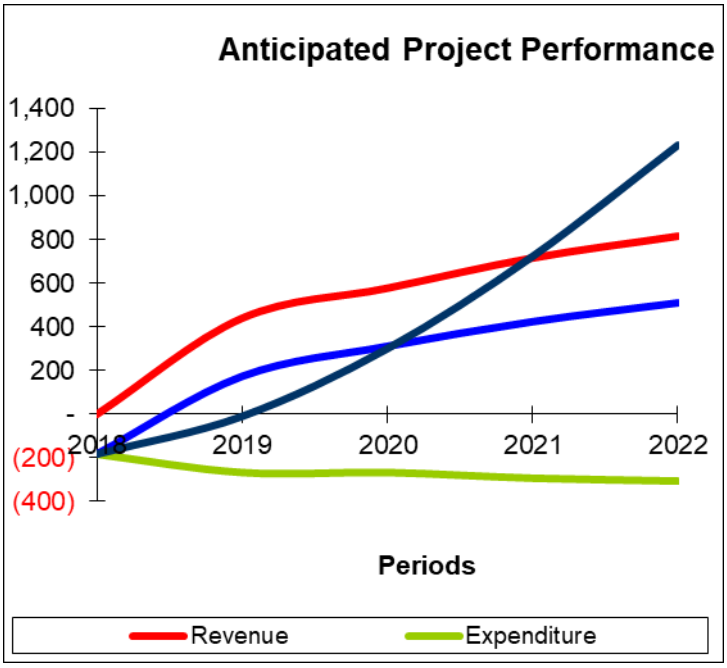
## Financial Summary

The following is an overview financial summary projection over a five-year period. See Global Carbon Data Financial Projections Spreadsheet for details.

Revenue of around £1.6M is anticipated from 2020 – 2023

## PROJECT SUMMARY

| | |
|---|---|
| 5 Year NPV | £1,047,981 |
| Total Investment | £1,300,389 |
| Total Net Benefits | £1,564,403 |
| NET CASHFLOW | £2,864,792 |
| Payback | 2020 |
| Estimated Start Date | 1 April 2019 |
| Estimated End Date | 1 April 2023 |




## CASHFLOW GBP '000

| Revenue / Expense Description | 2019 | 2020 | 2021 | 2022 | 2023 | Total |
|---|---|---|---|---|---|---|
| Revenue | - | 440 | 578 | 716 | 815 | 2,549 |
| Expenditure | (184) | (267) | (267) | (293) | (306) | (1,316) |
| **NET CASHFLOW** | **(184)** | **173** | **311** | **424** | **510** | **1,233** |

## PROFIT & LOSS

| Revenue / Expense Description | 2019 | 2020 | 2021 | 2022 | 2023 | Total |
|---|---|---|---|---|---|---|
| Revenue | - | 440 | 578 | 716 | 815 | 2,549 |
| Gross Margin | - | 440 | 578 | 716 | 815 | 2,549 |
| Opex | 184 | 267 | 267 | 293 | 306 | 1,316 |
| **EBIT** | **(184)** | **173** | **311** | **424** | **510** | **1,233** |

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## Project Cashflow GBP '000

| Revenue / Expense Description | 2019 | 2020 | 2021 | 2022 | 2023 | Total |
|---|---|---|---|---|---|---|
| **Year** | **0** | **1** | **2** | **3** | **4** | |
| **Revenue (+ ve)** | | | | | | |
| NGO Subscriptions | - | 20 | 21 | 21 | 22 | 84 |
| Corporate/ Government Subscriptions | - | 140 | 147 | 154 | 162 | 603 |
| Technology Development | - | 100 | 105 | 110 | 116 | 431 |
| Project Development Services | - | 100 | 105 | 110 | 116 | 431 |
| Customer Consultancy | - | 80 | 200 | 320 | 400 | 1,000 |
| **Total Revenue** | **-** | **440** | **578** | **716** | **815** | **2,549** |
| **Expenditure (- ve)** | | | | | | |
| Business and Commercial | 48 | 68 | 68 | 76 | 80 | 255 |
| Technology Consultancy | 48 | 49 | 49 | 52 | 54 | 255 |
| Marketing & Communications | 48 | 49 | 49 | 52 | 54 | 255 |
| Project Development | 20 | 40 | 40 | 48 | 52 | 255 |
| Travel & Administration | 20 | 60 | 60 | 64 | 66 | 281 |
| **Expenditure** | **184** | **267** | **267** | **293** | **306** | **1,300** |
| **Net Cash Flow Before Tax** | **(184)** | **173** | **311** | **424** | **510** | **1,249** |

**Figure 1: Summary of Revenue and Expenditure**

## Situation Analysis

Currently, several organisations provide certification for emissions reduction activities. For corporate customers delays in certification and the sale of carbon offsets is a disincentive.

For community projects, the lengthy delays and expenses of carbon offset certification completely halt development where there is no current methodology.

It is clear that applying emissions algorithms to the replacement of fossil fuels by renewable energy generators is a clear, accurate pricing mechanism.

Extension of land use carbon sequestration methodologies to provide carbon credits would be a clear signal to agribusiness investment to increase capacity.

Ready access to methodologies avoids many of the current roadblocks such as lengthy delays to establish new methods which are currently very expensive.

### Accuracy of Emissions Estimates

Markets dislike uncertainty. Today, 42 national and 25 sub-national jurisdictions put a price on carbon emissions (World Bank). Initially carbon prices for community projects are set by referencing available national and regional prices. Community projects future carbon credits are sold online by a managed bid mechanism and price per tCO2e.

Over time, publication of project data promotes the harmonisation and standardisation of the price per tonne of carbon dioxide equivalent savings. Data can be categorised and published by geolocation of aggregated nationally and regionally e.g. Western Europe, South East Asia, Australasia, Pacific Islands, North America, South America, Africa, longer term globally.

## Emissions Reduction Methodologies

By publishing methods, and calculations to an internet accessible subscriber platform, exposure of methods and peer review provide the following

1. An innovation in methodology development by engaging more emissions reduction expertise
2. Speeding up of methodology accreditation by facilitating peer review and publication
3. Minimisation of the potential for greenwashing by publishing methodologies
4. Over time eliminate weed out inaccurate methodologies that lower market confidence

Project information is freely, publicly available, and shared internationally with climate change relevant organisations, customers interested in engaging in emissions reduction projects and the public.

Project development for corporate customers is to connect commercial projects with a cost-effective path to carbon offsets.

Assistance for community project development is to source project finance.

## Paris Agreement

The current situation is that in the wake of the UNFCCC (United Nations Framework Convention on Climate Change) Paris COP21 Conference of Parties, the level of ambition by countries to address climate change has resulted in a significant growth in signed pledges for resources to address climate change, meaning that finance is being allocated in the direction of the climate science and private projects addressing carbon emissions reduction.

Currently, the greatest risks to an effective, timely response to global efforts to managing carbon emissions reduction are

1. Lack of knowledge by organisations addressing climate change of the power of distributed cloud infrastructure to gather carbon emissions reduction activity information in near real-time
2. Best practice inhibited because of too much uncoordinated information
3. Ineffective emissions reduction actions due to lack of standard, credible metrics, calculations and algorithms for monitoring carbon emissions reductions in all fields
4. Missed opportunities due to lack of sharing of knowledge internationally
5. Proliferation of ‘greenwashing’ because of political influence on, and the lack of standards for carbon emissions reduction projects
6. Perception that carbon pricing across international borders is too hard

Public policy, and interest from private sector institutional investment are raising the level of demand for accurate carbon emissions monitoring and reduction. This can only intensify over the next five years. In particular, it is expected that national electricity grids are to become a focus, and the trend

for increasing numbers of micro grids replacing existing ageing infrastructure to continue to be of interest.

## Opportunity

The Global Carbon Data Cloud program is to engage organisations addressing climate change related carbon emissions reduction technologies and research, to develop a cognitive international knowledge base of information resources comprising both structured and unstructured data.

Phase 2 is to take up opportunities to use cloud hosted ICT and IIOT technology to monitor carbon emissions, for example from renewable energy replacing fossil carbon fuels, collecting the data to a cloud hosted ‘big data’ repository. Subscribers can use web browsers for analytics and infographics.

This information is to be the basis of a strategic marketing campaign to interest subscribers from

1. Government carbon emissions reporting
2. Corporate energy efficiency programs
3. Regional and national carbon offset trading schemes, markets and exchanges

One of the major benefits is an impetus to the processes of developing standard carbon emissions reduction methodologies to apply to the full range of scientific and economic activities that can successfully reduce greenhouse gas emissions. A secondary benefit is to be the incentive to develop new technologies with demonstrable emissions reduction benefits, eligible for carbon pricing.

## Context

There are many United Nations, government, NGO and academic organisations providing information and services about climate change and carbon emissions reduction. These organisations, have published articles, research and data in their spheres of expertise. They are generally open to acquiring and sharing information about climate change related carbon emissions projects, economics and science.

While many of these organisations are in touch with one another, and already share information, the communications are not universal. Organisations involved with climate change operate in different countries, geo-political regions and languages. Also, as in many other fields, there is so much information available that it is difficult to keep track of what is available and what is current.

The knowledge collected by these organisations is in the form of both structured and unstructured data. Categorisation of these resources to a single standard taxonomy, stored in and referenced from common repositories, can ensure the accessibility and currency of information across organisations, scientific and technical disciplines, as well as across national and regional boundaries.

## Business Problem

The business problem that Global Carbon Data Cloud addresses is to accelerate access by government and corporations to relevant information resources, and standard emissions monitoring methods for addressing climate change.

This is to be achieved by

1. Publishing global community research and data
2. Providing ready and timely access to all relevant information for carbon emission reduction projects and climate science

3. Providing standard algorithms, metrics and calculations

### Stakeholder Impact

The effect on global organisations with an interest in carbon emissions and climate data is potentially a huge advance in accessing information from previously hard-to-access sources.

Carbon emissions reduction projects are expected to be facilitated by enabling the development of specific carbon monitoring methodologies by enabling access to, and networking with organisations with the appropriate subject matter expertise.

Organisations can identify other organisations that will provide value added opportunities through networking with special interest groups.

Knowledge workers can gain new sources of evidence to substantiate assumptions and help shape new hypotheses in their specific fields of interest.

Emissions reductions methods, algorithms, calculations and metrics can be improved, standardised to enhance accuracy of the real level of greenhouse gas emissions in the troposphere, the lowest level of Earth's atmosphere. This is a desirable outcome for the business community, governments, carbon markets and the public.

## Business Model

### Business Environment

The current business environment is encouragement by public policy to invest in high quality low carbon technologies. One of the incentives is carbon taxes and trading schemes to make carbon emissions reduction investment attractive.

New low carbon technologies are increasing in strategic importance, as governments, cities and the public become increasingly aware of climate change. The current lack of interest and lack of knowledge is forecast to dissipate as extreme weather events proliferate.

There are still some challenges to be addressed.

- Lack of understanding by investors of which technology to back to effectively reduce emissions
- Adverse publicity by the fossil carbon energy industry
- Wildly fluctuating prices amongst national and regional carbon markets
- Weak connection between the carbon emissions reduction and energy efficiency projects and the activities and the methodologies supported by current carbon markets

On the positive side, institutional investors are showing an increased enthusiasm for low carbon technologies and are looking to become better informed. In the wake of COP21 Paris Agreement December 2015, the UN member countries pledge to radically increase activities to limit temperature rises from carbon emissions intensive energy use.

## Customer Services

To achieve the objective of real tCO2e savings:

1. Commercial projects pay directly for initial assessments, as well as subsequent guidance for eligible projects to carbon offsets based estimated lifecycle tCO2e savings in the context of the local ecology to achieve certified carbon offsets.
2. Organisations with appropriate climate change and emissions monitoring expertise assess and monitor projects as paid service providers.
3. Service providers are paid for both commercial and community project assessments and development of methodologies.
4. Commercial customers elect to sponsor/buy future carbon credits from eligible community projects.
5. Community projects are referred to service providers using validated methodologies to gain carbon offset certification.
6. Projects are connected with carbon offset trading service providers with access to existing carbon markets to achieve maximum value for carbon offsets.
7. Community projects services are provided based on the value of the verified emissions reduction potential. This means that initial assessments, offset certification, and development of new methodologies are to be provided at risk. This risk is to be shared with sources of green finance.

## Technology Services

A public hybrid cloud platform with high speed content delivery capabilities can offer the following services:

1. Registration for community projects applying for finance on the eligibility basis of assessment of project emissions reduction potential over a determined lifecycle.
2. Online workflows connecting projects to organisations that can provide stewardship including access to appropriate emissions reduction methodologies
    a. Determination of eligibility of projects for finance by steward organisations based on emissions reduction potential
    b. Assurance in the form of validation of carbon offsets by certification providers
    c. Connection with low cost green finance providers
3. Online publication of data from eligible project carbon offsets in the form of
    a. Validated tCO2e emissions annual and lifetime reduction estimation calculations
    b. Ongoing progress reports on project monitoring by steward organisations applying compliance measures based on standard methodologies.
4. Online offering of carbon emissions reduction reports published in a standard format based on eligibility assessments.
5. Customer connection to online sales of tCO2e offsets.
6. Gateway to financial and accounting services for sales transactions settlements, payment of finance to projects, and payment of service provider fees and commissions.
7. Online analytics capability for aggregated anonymised project data by region, project type, category, geolocation, type of climate, biome and ecology.
8. Public search capability to access project methodologies, estimations and carbon offset sales.

9. Premium customer cognitive search services for access to targeted global climate change structured data (data series, collections, algorithms etc) and unstructured data (reports, research, methodologies)

## Customers

Consumers of the cloud services and data are expected to be

1. Government and corporations who want to access carbon emissions data, reports, science, economics and project statistics and information
2. Projects seeking compliance with emissions reductions standards and methods to earn carbon credits in carbon trading schemes and markets
3. Local community renewable energy schemes seeking to validate emissions reduction for participation in carbon trading schemes and markets by replacing fossil carbon fuels with renewable energy
4. Public looking for information about climate change

Governments and corporations are offered premium subscriptions to data, calculation algorithms, research and reports via web browser from mobile devices and the internet. These premium subscribers pay a fee to access an automated searchable-by-topic index of published climate change and carbon emissions information can be made available via cognitive analysis software. This is different from text-based search engines.

Cognitive search is based on the way terms are used and the context of the information contained in *the reports and data, and relates to both unstructured data (information such as reports and research), and structured data (such as time-series and carbon emissions analytics databases)

## Project Development Services

Credible organisations with climate change and tCO2e reduction knowledge and expertise are engaged on a fee for service basis for both commercial customers and community projects for initial project assessment and project development.

After an initial assessment estimates that the tCO2e from the project lifecycle is cost effective, a proposal is made to guide the eligible project development through to carbon offsets certification. This includes development of new methodologies if required.

Commercial customers pay for all services at market rates.

For community projects, after an initial assessment finds a project eligible, finance must be secured prior to project development. Community projects are funded by finance, and sales of future carbon credits, are charged significantly lower fees for stewardship.

When a steward organisation is connected to a project, they engage in project approval process workflows, which starts the process for which fees can be charged for project development.

Community projects are provided free initial project assessment. The program provides a standard fee for community project assessment to service provider(s). Once an eligibility assessment establishes a realisable potential for tCO2e abatement, finance is sought either from connection with carbon markets, or direct sale to customers. Project assessment fees are deducted from sales.

## Challenges

1. Whilst the technology can enable a concerted international effort to address climate change without a formal top-down approach to collaboration, there are challenges to be overcome.
2. Co-ordination of standard emissions reduction methodologies across a number of organisations
3. Countries slow to get started addressing carbon emissions reduction
4. Attracting interest from climate change organisations and government agencies
5. Obtaining buy-in from government customers depends on the speed at which countries mobilise efforts to address climate change
6. Stakeholder interest in monitoring carbon emissions data with information technology must be encouraged.

## Benefits

Major benefits from the Global Carbon Data Cloud Program are as follows:

1. **Carbon Emissions Governance** can be applied to new technologies and projects, on a scientific basis by engaging relevant global organisations to monitor projects on line, on a scientific basis, using existing standard emissions reduction algorithms or developing new methodologies based on co-operation and collaboration amongst academic, NGO, and international climate change experts.
2. **Global Carbon Knowledge Base** can engage organisations and individuals to share research, knowledge, reports, algorithms and methods for reducing emissions by becoming subscribers of the Global Carbon Data Cloud program.
    a. Consolidation of information resources
    b. Foster communication amongst all types of organisations and SMEs
    c. Raise awareness of carbon emissions monitoring technologies
3. **Global Carbon Metrics** is to use technology to develop specialist accurate metrics that can be used to demonstrate a consistent repeatable method of measuring emissions reduction methods.
    a. Measure renewable energy replacement of fossil carbon at the electricity grid
    b. Calculate carbon emission reduction from renewable energy and other energy efficiency measures
    c. Provide access to accurate carbon factors and algorithms
4. **Global Carbon Analytics** is to develop technology to provide accurate carbon emissions analytics across regional, national and organisation boundaries.
    a. Publish carbon emission reduction from project activities in near real-time
    b. Provide near real-time analytics and infographics.
5. **Global Carbon Pricing** is to develop an integrated carbon pricing mechanism based on standard algorithms, calculations and business rules.
    a. Harmonisation of pricing across national and regional carbon markets
    b. Facilitates new carbon emissions reduction methodologies

c. Provides spot pricing for carbon emissions reduction

## Program Delivery

The Global Carbon Data Cloud Program initial deployment can be delivered in a 12 months' timeframe

**Figure 2: Global Carbon Data Cloud Program Development Phases**

| Activity | Description | Timeframe |
|---|---|---|
| Project Inception | Business concept and proposal. Raise seed funding. | March 2019 – September 2019 |
| Web Access | Development of web applications for registration, for projects, service providers, topic and social media notification, online marketing for community projects | October 2019 – March 2020 |
| Project Workflows | Development and deployment of role based workflows | |
| Financial Services | Development of links to financial service providers, accounting, billing and payment gateways | |
| Carbon Market | Development of connections to carbon market services, pricing, calculators and interfaces | |
| Knowledge Base | Development of web crawl and cognitive search capability for structured and unstructured data (emissions factors, algorithms, time series and metrics, research, reports) published by climate change organisations. | |
| Carbon Offset Services | Developing interfaces and links to emissions calculations, algorithms and metrics. Establishing relationships with carbon offsets, pricing and trading organisations | |
| Marketing | Campaigns to sign up customers (governments and corporations) steward organisations (compliance and monitoring) and raise awareness of requirements for eligible community projects | Jan 2019 – Mar 2020 |
| Analytics | Development of analytics and infographics of aggregated emissions reduction data and emissions monitoring dashboard | Jan 2019 – Mar 2020 |

# Appendix A: Global Carbon Emissions Data Outputs

## Global Carbon Metrics

To address the challenge of inaccurate carbon emissions measurements, an obvious place to start is the production of electricity, which is already well served by information technology. Metrics of energy data can deliver supply and demand and cost efficiencies for energy generation, as well as carbon trading, across national boundaries.

Synchronisation of data definitions, through adherence to a specific messaging model can optimise technology services providing integration for collected energy transmission data. A location centric repository can provide management for data structures, transformation algorithms and messaging protocols.

Connection of energy data with information delivery services, enables operational data from Smart Grid network devices to be collected, stored, analysed and published on the web. For each network operator, interoperability of data can be facilitated by translation into common formats via automated connectors. Geospatial standards and common messaging data formats can play a fundamental part in communications.

New renewable energy data micro-grids can be connected to these services, to extend near real-time intelligence to renewable energy generation replacing fossil carbon energy generation in any region or country. A prototype can provide the core mediation, calculation and transformation processes for reuse with standard technology services.

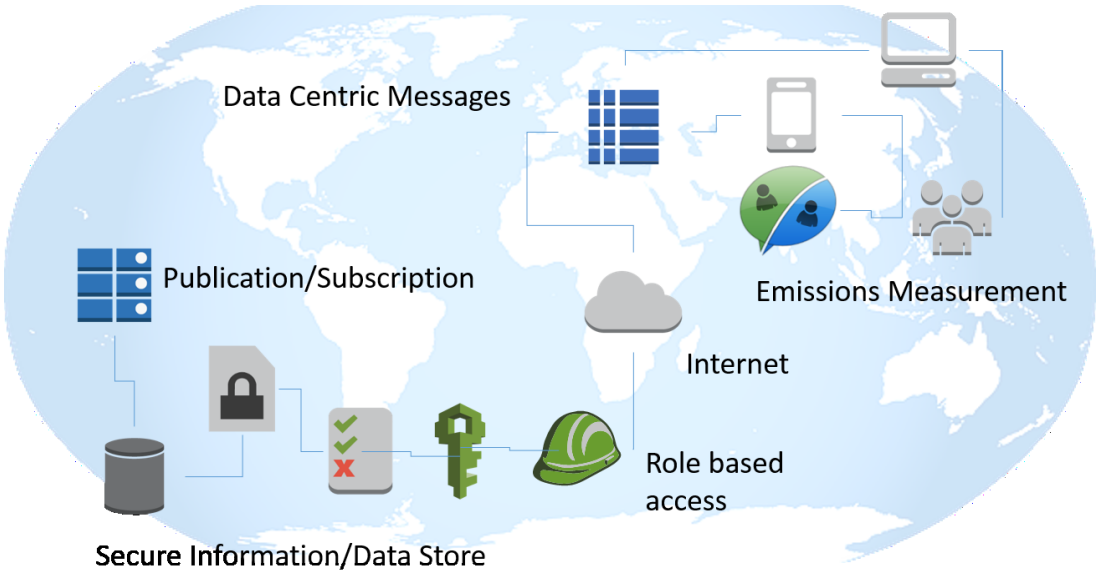


**Figure 3: Carbon emissions reduction metrics from renewable energy micro grids**

## Global Carbon Analytics

Carbon emissions reduction metrics provide the basis for government, NGO and public near real-time reporting on international efforts to reduce global warming. Real-time Industrial Internet of Things (IIOT) enables the collection of automated energy data to which can be applied carbon offset algorithms, depending on the type of fuel being replaced.

Initially, data from power generators can be collected from energy companies and Transmission Network Operators, preferably in near real-time, and from forecast demand schedules. Data can be collected from scheduled transmissions, as well as from smart grid network devices to supply near real-time metrics of supply of renewable energy generation replacing what was formerly supplied by fossil fuel energy.

Data collected from micro-grids can be mediated into a required format for analysis purposes, from different data stores. The metric tons of CO2e abatement (Carbon Dioxide Equivalent or the standardised Global Warming Potential of emissions caused by human activity) can be calculated using standard emissions monitoring algorithms.

Carbon emissions reduction data can be aggregated by geography and over time, to provide a comprehensive global picture of the current efforts to address climate change.

New methodologies are developing for monitoring emissions reduction from, for example, agriculture and prevention of deforestation, vehicle fossil fuel replacement. Telemetry measurements from the IIOT, the Industrial Internet of Things, can be applied to calculate energy savings. Data such as the area of forestry saved, the hectares of carbon sequestering crops planted and grown, the volume of low carbon building materials used in construction projects, can be stored, and reported to demonstrate energy efficiency and reduced emissions, useful information for countries to reduce greenhouse gases in the atmosphere.

Time series and location-based data is clearly required over the next decade by countries and corporations to understand where best to invest to optimise technology, financial and human resources.

## Global Carbon Pricing

Specialist knowledge of IPCC algorithms and emissions factors can be engaged to determine the rules for carbon pricing, to be applied to activities qualifying for credits/offsets on carbon exchanges and markets. Applications can be used to apply the business rules and logic for accurate emissions reductions calculations to offer online to potential buyers of carbon offsets and credits.

As well as pricing carbon emissions reduction for replacing fossil fuels with renewable energy, carbon offsets/credits can be bought by companies obliged to demonstrate emissions reduction at the going carbon price. This approach would attract customers with all types of emissions regulations, both taxes and emissions trading.

By integrating data using cloud technology, emissions reduction metrics from national and regional abatement project meeting a required standard can be offered to a wider market.

One of the anticipated effects of making carbon pricing information available online, is, over time, a natural gravitation and harmonization of the price per metric tonne abated, across the regional and national markets. It would also increase the business levels of the nascent carbon trading exchange mechanisms that are currently in operation to support the demand for investment in projects to reduce greenhouse gases.

Data gathering mechanisms can provide a sufficient level of accuracy for market spot pricing, and the accuracy can only increase as methods and monitoring mechanisms are improved over time.

There is an enormous opportunity to apply carbon emissions monitoring algorithms to demand and consumption data, providing carbon pricing discounts on the spot to encourage wholesale and retail buyers of electricity from renewable sources.

This approach is an organic way to encourage growth for those companies with innovation in low carbon technologies such as renewable energy and storage from solar, geothermal, wind, tide, wave and other emerging energy generators.

In parallel, there is a market incentive to develop accurate monitoring mechanisms for other carbon emissions reducing activities such as protecting forests, cleaning up ocean plastic, and planting carbon sequestration crops. These activities would be fostered by the ability to earn money for carbon offsets/credits. Projects can be steered towards using verified monitoring methods.

Once the technologies for collection and analysis of carbon emissions reduction metrics are in place, a pilot program can be put in place to set up the market mechanisms with an existing established emissions trading scheme, and a carbon exchange market. From this pilot, the technology can be offered for integration of global carbon markets.

# Appendix B: Global Carbon Data Program Delivery Services

The following software, platform and infrastructure services are provided on hybrid public cloud platforms.

## Customer applications

Secure registration, identity management, workflows and application services for community project assessments, carbon accounting service providers, emissions reduction methodology providers, government and corporate customers.

Real-time network and compute infrastructure, platform and software services to connect projects, emissions monitoring suppliers and carbon offset customer applications.

Business information services to

1. Online workflows for project approval processes.
2. Integration with carbon offsets calculations, pricing and trading services.
3. Access to project information analysis by category e.g. geolocation, climate type, biome type, local ecology
4. Access to peer review and publication of carbon emissions reduction estimation methodologies, calculations and algorithms
5. Integration with project finance approvals processes, accounting services and payment gateways
6. Web analytics, time series data and infographics for aggregated project data

## Platform Services

1. An easy-to-use web registration process for projects, service providers and customers
2. Cognitive search services for structured and unstructured data.

3. Security standards compliant encryption of all sensitive information access, data transit and data storage.
4. Online peer review and publication processes for methodologies and project reports.
5. Project development status reports
6. Web services providing access to methodologies, automated calculators, and carbon offset validation service providers.
7. Secure online market for community project bids and sales
8. Secure integration with financial and accounting services, calculation of commissions, fees and charges, and settlement of transactions via secure payment gateways
9. Secure integration with carbon trading/ market services.
10. Integration with carbon accounting data
11. Project analytics and infographics dashboards

## Cloud Infrastructure Services

1. Secure cloud network, compute and storage services
2. Secure online registration, and role-based approvals workflow applications
3. Role based secure identity and access management services to project emissions reduction data and related information
    a) Searchable taxonomy of common terms to the carbon emissions knowledge resources inferred from the data content
    b) Subscriptions based secure access to project, economic and scientific data, reports, analysis and articles by topic
    c) Integrated dashboards of calculators, emissions factors and algorithms for demonstrating carbon emissions reduction
    d) Gateways to external financial, accounting, billing and payment services
4. Automation of methodologies and links to methodologies including algorithms for emissions factor applications, calculations and pricing to enable subscribers to apply emissions factors to data aggregated from greenhouse gas reduction activities.
5. Notification and data services on a topic subscription to published information
6. Connectivity to access to carbon trading schemes, exchanges and markets in near real-time for carbon emissions reduction data for carbon pricing.

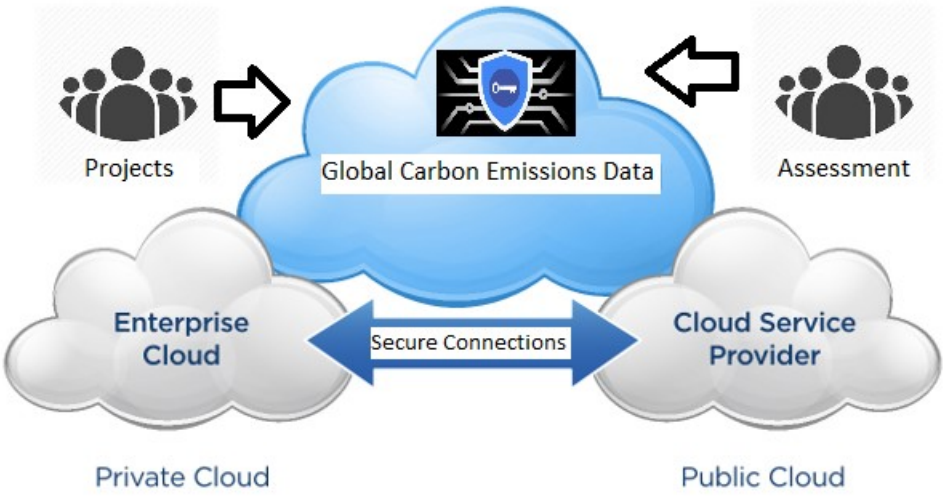


**Figure 4: Hybrid public cloud infrastructure overview**

1. Development using cognitive analysis of a carbon emissions monitoring taxonomy for structured (algorithms and metrics) and unstructured data (reports and research) for use by web subscription
2. Development of access and interfaces to carbon emissions metrics from organisations with standard carbon emissions monitoring algorithms and calculators
3. The collection of the emissions metrics using data technologies, cloud hosting, and adaptors to web analytics and infographics across geographic regions.
4. The application of emissions monitoring analytics, time series, statistics and infographics
5. The application of the carbon pricing algorithms to carbon markets and exchanges

## Global Knowledge Base

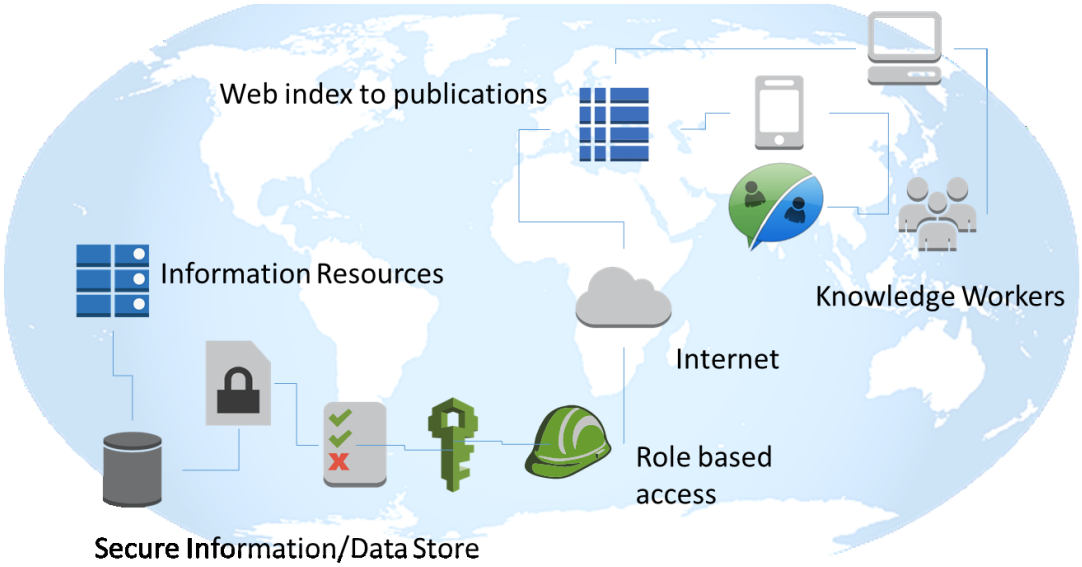


**Figure 5: Cloud knowledge base technology overview**

A web accessible global knowledge base of reports, research, algorithms, emissions factors and projects is an excellent way to spell out the benefits of sharing information to establish a global price for carbon emissions reduction across borders, cultures, and organisation boundaries.

Cloud technology can provide a common global store of information about carbon emissions and climate change. Data services for both unstructured data (text and media based content) and structured data (information stored in databases) can be referenced, collected and stored from publicly available information resources provided by climate relevant organisations. Researchers can gain access to the information resources by an index from technology that automatically builds a relevant taxonomy that can be fine-tuned manually by subject matter experts.

Subscribers use a web interface for guided, taxonomic search and access to relevant information resources. The taxonomy to classify documents is built and updated as the knowledge base grows. Links to data may be to publishers' own websites, or to data uploaded to the cloud-hosted data store. Information is correspondingly both relevant and current.

A major benefit of the taxonomy is to normalise and standardise the terminology used by various organisations. A simple example can be seen in the image below, where documents that contain *Sea defences* or *Sea walls* will be classified as being about *coastal erosion and protection*. This makes searching across many different sources more consistent as the varying terminology used within each organisation can be incorporated into, and complemented by the taxonomy and its clues.

Once the taxonomy is built, documents can be stored centrally on a secure cloud hosted service or accessed via link to the originating organisation's website. As new documents are added, the taxonomy can be easily updated to ensure a current, common and consistent classification based on the actual content being written about climate change and carbon emissions as it changes over time. The ability to go to the original document source ensures that the information remains current.

Information can thus be categorised and made accessible by all commonly used terms in all participating stakeholder organisations that publish their data.

As well as unstructured research and reports, structured data such as carbon emissions factors, calculations and algorithms can be shared and published, ensuring that best practice carbon emissions factors are shared internationally.

Calculators using standard algorithms for carbon offsets can be linked or developed. These calculations provide the basis for applying standard carbon pricing for carbon markets. Publishing standard methodologies can help the harmonisation of carbon pricing from regional and national carbon emissions trading and taxation schemes.

## Security

One of the most important aspects of the technology to facilitate exchange of knowledge and information about carbon emissions reduction, is security.

Best practice security architecture for infrastructure, data in transit, and data at rest in storage and identity management for data access is essential.

For web access to information, multi factor authentication (more than one identity test), OAuth and Software Defined Perimeter specifications have emerged to counteract the sophisticated attacks on encrypted and secured internet communication channels.

The OAuth 2.0 access authentication and authorisation standard provides for a very specific set of communications between parties to access information. Device recognition technologies can be used to good effect, and use of best practice for certificate servers are available to secure data.

Software Defined Perimeter security provides for authentication and authorisation of both device and user prior to access to access to IP networks.

A common security policy can be developed, implemented, tested and deployed during prototyping by collaborative effort amongst technology suppliers.

## Hybrid Public Cloud Deployment

The technical environment is to be cloud hosted, able to be deployed across multiple public and private clouds, as required. The basic functional capability is to be:

1. Storage of information resources
2. Auto-classification and development of relevant multi term taxonomy
3. Secure access to read information resources
4. Web interface to access information
5. Taxonomic suggested (cognitive) search by topic
6. Update of the original taxonomy on an ongoing iterative basis
7. Multi-language information translation
8. Facilitation of communication amongst stakeholder organisations and individuals

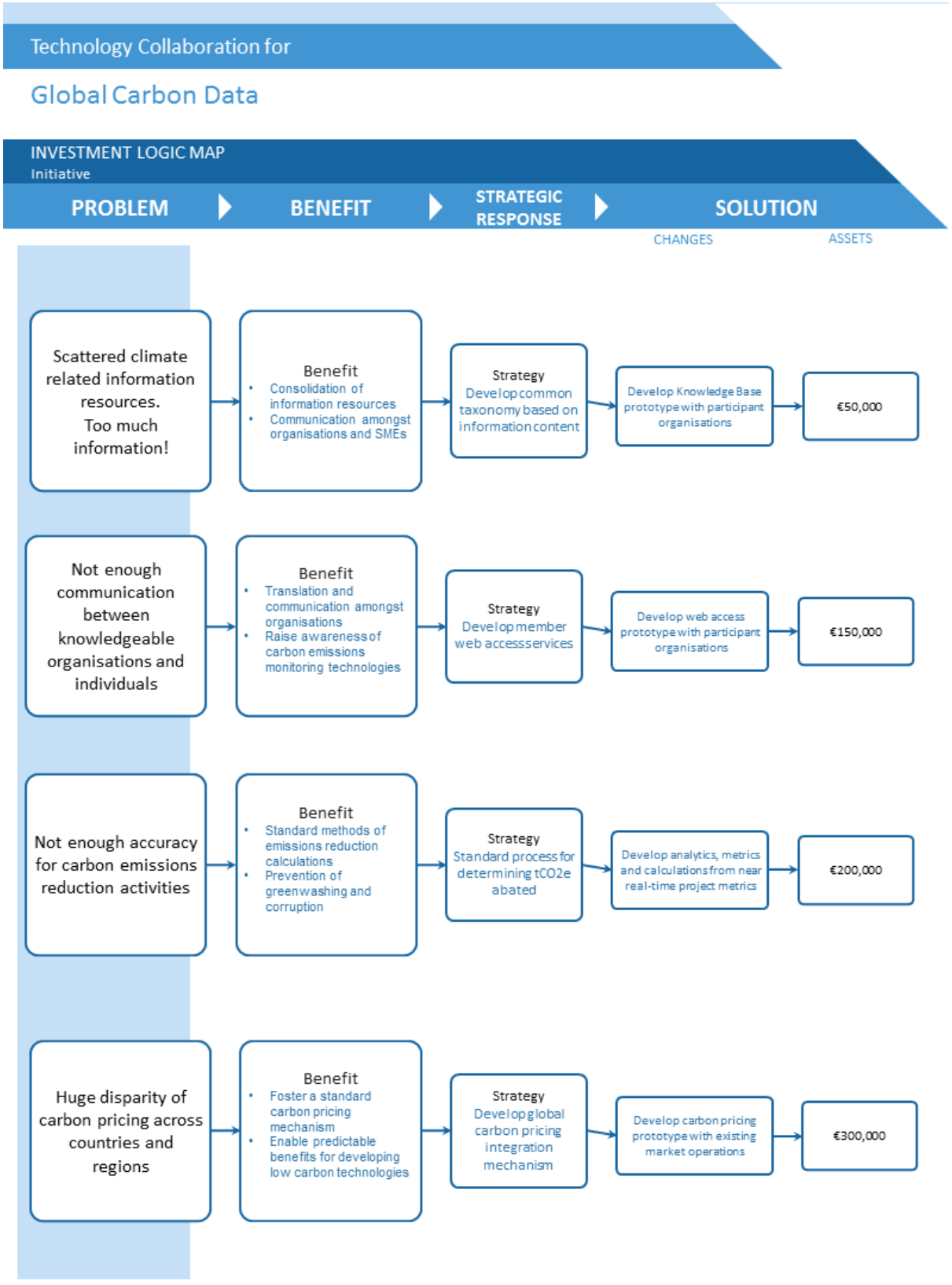


**Figure 6: Investment Logic Map Global Carbon Data Cloud**

## Solutions Development and Deployment

The following activities are required for development of hybrid public cloud infrastructure.

1. Selection of services to comprise the climate change taxonomy development from existing carbon emissions reduction information resources provided by participant organisations.

2. Selection of cloud hosting provider, critical to ensuring data privacy, and information security, particularly as the medium-term objective is to store carbon emissions reduction data.

3. Development of web access for subscribers - Note: The initial choice of technical environment includes consideration of future security requirements, such as encrypted access to endpoints on other cloud platforms, with standard cloud-to-cloud access protocols such as OAuth 2.0, for both Global Carbon Data Cloud acquisition, classification and transformation, as well as end users, both registered to private data as well as publicly accessible data (subsequent program phases can be facilitated by extension of the applications on the same infrastructure, with no redevelopment required).

4. Build out a securely hosted cloud platform, with the flexibility to grow the infrastructure and data storage on demand, without downtime, with the ability to add new functions over time, - such as real-time data integration, analytics, infographics, automated decisioning and calculations, are all easily configurable from connected cloud platforms with regional presences as required.

5. Ensure the cloud hosting performance in all global regions by a global wired and wireless network presence. Subsequent program phases require data access technologies and edge-of-network caching of frequently used resources to provide end users with high-speed responses to searches, queries and calculations. Information can be provided from any part of the world with no performance problems. Data can potentially be hosted in any region.

6. Development of information and governance models. As technology is still changing rapidly, flexibility and a strong governance model is important to ensure ongoing data security and identity and access management of the Global Carbon Data Cloud participants. To this end, data encryption in transport and in storage is a technical requirement, meaning that stakeholders are required to register to publish, subscribe to and access information resources. By the same token, information models for carbon emission data must be made available to all technology providers

7. Ensure measures are in place to detect and address application vulnerability, prevent malware intrusion, and with infrastructure monitoring by the cloud provider to secure the GCD information resources. By designing for security and growth from the outset, the Global Carbon Data Cloud platform is to be flexible, change-enabled and ready to respond to changing market conditions, ensuring its future state.

In summary, the technology infrastructure is to provide high speed real-time messaging of carbon emissions monitoring data, such as from renewable energy generation metrics, to be stored and accessed in the cloud by web query, as well as big data analytics, providing individual and role based services to subscribers.

## Implementation Approach

The approach is to engage with technology suppliers to supply the technical services to the program, in parallel with using Climate Home services (including their subscriber database and newsletters) to market to high-profile stakeholder organisations.

Estimates in this document are to be subjected to a second pass to determine final costs for Phase 1 and subsequent phases as enough information becomes available.

Technology suppliers are to be engaged on a fee-for-services contractual basis, and the terms of engagement to be agreed, subject to completion of a successful proof of concept.

Costs for the proof-of-concept are to be raised from an investor interested in supporting the reduction in greenhouse gas emissions.

## Project Governance

Project delivery is to be governed by information collected in the inception and elaboration phase of the program, documented in the following artefacts.

1. Solution Design
2. Requirements Specification
3. Project Management Plan
4. Risk Management Plan
5. Risk Register
6. Benefits Management Plan

Artefacts are subject to peer review and program approvals processes.

Quality-of-Service is to be addressed as part of architecture and design, providing input into the contractual agreement with technology suppliers.

Technology suppliers are to engage collaboratively to be managed by a program governance mechanism to be determined by program steering group.