THE CROWN ESTATE

Total Contribution Methodology

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www.thecrownestate.co.uk

www.route2.com

Contents

Part 1: Overview

1.Introduction

The Crown Estate is a commercial business that consistently outperforms the market. We believe sustainable growth is central to our business resilience, underpinning our competitive advantage and out-performance of our benchmark. Total Contribution plays a vital role in this by providing us with a deeper understanding of the impact of our decisions on our capitals. Ultimately, it demonstrates the bigger contribution we make beyond our financial return.

Since publication of our inaugural report in 2013, we have been working in collaboration with advisors at Route2 to evolve our methodology into a unique approach which enables us to measure our impact on our capitals, and to become a decision-making tool. This document describes the evolution of our approach and how we generate an economic value for each of our indicators.

Total Contribution is a methodology which demonstrates the value we create by measuring the impact of our activity on the capitals on which we depend.

2. Evolution of approach

Our approach has developed significantly since our 2013 report.

The aim of the 2013 report was to demonstrate the value we create beyond financial return across the triple bottom line. It was based on a limited number of indicators each with different units of measurement (e.g. tonnes of CO2e and m3 of water). We realised that to better understand our value and to influence decision-making we needed to:

- Develop a framework based on our capitals (in alignment with our business model and Integrated Reporting) and the respective capital flows resulting from the activities we undertake.
- Increase the number of positive and negative indicators with, where possible, fair representation of our impact across each of the capitals.
- Find a common unit of measurement to provide a means of comparability and aggregation (for the purpose of measuring aggregate performance over time).

Working in collaboration with Route2, the Total Contribution steering committee worked over a number of months to shape the approach we have today. The current approach addresses all of the above challenges. It has the ability to measure value created and great potential as a decision-making tool. The following pages detail the current basis of Total Contribution.

We believe it has great potential but acknowledge there is still room for improvement. We will be working to refine the model in collaboration with other businesses and organisations.

3. Principles of transparency

We work on three principles of transparency.

Credit
We are clear whether the contribution we are stating is direct, indirect or enabled.

To help us understand and report on who is responsible for what, we group activities under three headings:

- Direct activities: those we carry out ourselves.
- Indirect activities: those we commission and are carried out by our supply chain.
- Enabled activities: those we enable through the leasing of our land and property, and are carried out by others.

Confidence
We are clear about our assumptions and say how confident we are in the data.

It's not possible to capture primary data for every indicator so we use recognised methodologies, models and research to estimate results where necessary. We make data sources clear in all cases. Since our first report there have been two developments concerning this principle:

- The introduction of a more systematic internal confidence scoring system.
- An Insight Report produced by PwC on the maturity of the data and the overall approach (see online at www.thecrownestate.co.uk/TotalContribution).

Contribution
We include both positive and negative indicators so we can show a net impact.

This helps to give a more balanced picture of our impact and to highlight where we need to focus our efforts.

4. Framework

The Total Contribution approach is based on the **capitals** we rely on to do business and the change in their condition as a result of our **activities** and **external influences**.

4.1 Our capitals

During the course of our business we use and draw upon our stocks of financial, physical and natural resources , together with the people working for us, their associated know-how, and trust within our networks.

Financial resources	Finance available to us to run and grow our business.
Physical resources	Property, plant and equipment, and other manufactured goods we own and use.
Natural resources	Ecosystem goods and services, such as minerals, carbon sequestration and biodiversity provided by the natural environment that we manage and use.
Our people	Skills, competencies and experience of our employees.
Our know-how	Collective expertise and processes.
Our networks	Trust between stakeholders which facilitates all activity.

4.2 Flows

Of course the condition of the stocks outlined above are not static. Through our different activities we change their condition, either enhancing or impairing their capacity to deliver services. These changes to condition can be categorised in terms of capital flows - investment, depreciation or appreciation. Additionally, we take account of capital outputs.

- **Investment (positive flow)** relates to interventions made to maintain or enhance (quantitatively and qualitatively) the value of our capitals. For example, planting trees to increase timber yields, training to improve employee productivity and self-confidence.
- **Depreciation (negative flow)** relates to impairment of the value of our capitals either through day-to-day business activities (internal), e.g. an injury to an employee via a workplace accident; or via external events (natural, social or physical) (external),e.g. damage to property through crime.
- **Appreciation (positive flow)** relates to the enhancement of value our capitals either through day-to-day business activities (‘internal’), e.g. via increased ‘employee engagement’, or via external events (natural, social or physical) (‘external’), e.g. favourable weather increasing agricultural productivity.
- **External Costs (negative flow) and Benefits (positive flow)** relate to the capital services that escape the market mechanism and therefore do not feature in financial accounts. The former, external costs, refer to inputs necessary for our activities, derived from capital not owned or controlled by us and for which no financial costs are incurred by us. The latter, external benefits, refer to the outputs from our activities derived from capital owned and controlled by us, for which no financial revenues are received. For example, cost inputs might include pollution within legal levels, for which we don't recompense society. Benefit outputs might include carbon sequestration from our forestry assets, for which we receive no payment.

Understanding and managing these flow types, both individually and in combination, within and across our capitals, is fundamental to the delivery of financial return and the creation of wider value.

The inter-relationship of the capitals and flows is illustrated, with example indicators, in the framework table overleaf.

Total Contribution Framework with example indicators

Capitals	Investment	Depreciation of Value - Internal	Depreciation of Value - External	Appreciation of Value - Internal	Appreciation of Value - External	External Benefits	External Costs
	(+) Positive flow	(-) Negative flow	(-) Negative flow	(+) Positive flow	(+) Positive flow	(+) Positive flow	(-) Negative flow
Financial Resources	The respective flows for financial resources are fully reflected and integrated e.g. profits generated and captured within Gross Value Added.						
Physical Resources	e.g. new development	e.g. building damage via workplace incident	e.g. building damage via flooding (natural)	e.g. additional functionality for existing building	e.g. new policy such as feed in tariff regime increasing the value of renewable energy installations	e.g. free use of space by community groups	e.g. use of public infrastructure without payment
Natural Resources	e.g. additional forestry planting	e.g. mineral resource depletion through extraction	e.g. new policy restricting agricultural activity (political)	e.g. land management practice generating greater soil fertility	e.g. new policy creating additional functionality of seabed (political)	e.g. production of ecosystem services	e.g. greenhouse gases emitted
Our People	e.g. employee well being programmes	e.g. sickness absence	e.g. seasonal epidemic (social)	e.g. greater employee engagement	e.g. improved work-life balance (social)	e.g. employee volunteer schemes in working hours	e.g. under-compensated labour
Our Know-how	e.g. employee training and development programmes	e.g. employee turnover	e.g. obsolescence of existing skill set through innovation (market)	e.g. learning by doing	e.g. new policy creating additional functionality for skills (political)	e.g. production of public information, i.e. knowledge sharing	e.g. consumption of public information
Our Networks	e.g. community investment projects	e.g. late payment of suppliers	e.g. economic downturn straining relationships (market)	e.g. placing unemployed into employment	e.g. economic upturn strengthening relationships (market)	e.g. enhanced visitor well-being	e.g. reduced visitor well being

5. Economic valuation

We know that we contribute more to the UK economy and society than the financial return we deliver. But this is difficult to quantify without a common unit of measurement. It is also difficult to identify which activities are furthering or hindering our objectives, and to what degree. The Total Contribution approach has gone a long way to addressing these issues.

5.1 Common unit of measurement

Total Contribution encompasses an array of impacts, comparing activity as diverse as planting green spaces and helping people to find employment. We have attempted to represent these impacts in measurable performance indicators. Working collaboratively with advisors Route2, and following exhaustive discussion internally, we decided to use an economic value as our common unit of measurement for all of our indicators. One strength of the economic valuation approach for comparison and aggregation is the subsequent ability to build on conventions (as illustrated in the development of adjusted Gross Value Added (see p13).

Economic valuation enables us to:

- Understand the magnitude and relative impacts of different indicators.
- Integrate indicators with conventional finance-based management systems and apply this to business decision-making.
- Aggregate the values of all indicators, netting off the positive and negative values to develop a Total Contribution trend line year-on-year.

We recognise this is an evolving system, especially with regard to social indicators, but it is a big step in the right direction. We do not claim that the valuations are absolute but they do provide us with a deeper understanding of the effects of our actions, which can influence decision making and make us a stronger business.

5.2 Valuation

We collect data for each direct, indirect and enabled indicator at the end of the financial year. If the data is already expressed in financial terms, e.g. the amount we have invested in private health care for our employees, then that is the figure used. For data presented as a non-financial unit of measurement – for example, tonnes of CO2e – we research and apply an appropriate unit social cost/benefit value, or we develop and deploy an economic valuation method. This is relatively straightforward for direct impacts, but as primary data is rarely available for indirect and enabled impacts more estimation and assumptions are involved. The approach adopted for the calculation of indirect and enabled indicators is detailed in section 7.

The translation of non-financial indicator values to financial costs or benefits follows one of three broad methods.

Method 1 – high confidence - applying unit cost or benefit values, published by governmental agencies or peer reviewed journals, to the indicator's non-financial value e.g. the social cost of carbon (£/tonne) as published by the UK Government and applied to total tonnes of greenhouse gas emissions.

Method 2 – medium confidence – using economic valuation models or guidelines, published by governmental agencies and respected research institutions, which require data population e.g. the UK Health & Safety Executives guidelines for establishing the social cost of workplace injuries.

Method 3 – low confidence - using more bespoke and 'experimental' methods, informed by relevant literature, e.g. literature proposing and evidencing the relationship between equal opportunity within firms and financial performance.

Inevitably, we generally have a lot less confidence in the values applied to indirect and enabled impacts. More research will be undertaken for all Method 3 values.

See section 8 for detail on how each indicator is calculated.

5.3 Indicators

We have developed over 60 performance indicators to provide balance across our capitals and which reflect both positive and negative impacts. They cover our direct, indirect and enabled impacts and, of course, are not exhaustive. This full list includes indicators for which data is not yet available or where we have only just established a baseline figure.

The table overleaf shows the 35 indicators which are currently measurable and for which we have data on our direct impacts. It also gives the level of confidence we have in the Total Contribution value calculated against each of them (as explained in 5.2 above). We will continue to work to improve the maturity and rigour of the indicators.

Please see here [link to www.thecrownestate.co.uk/TotalContribution] for the current economic values based on the average of three years' data.

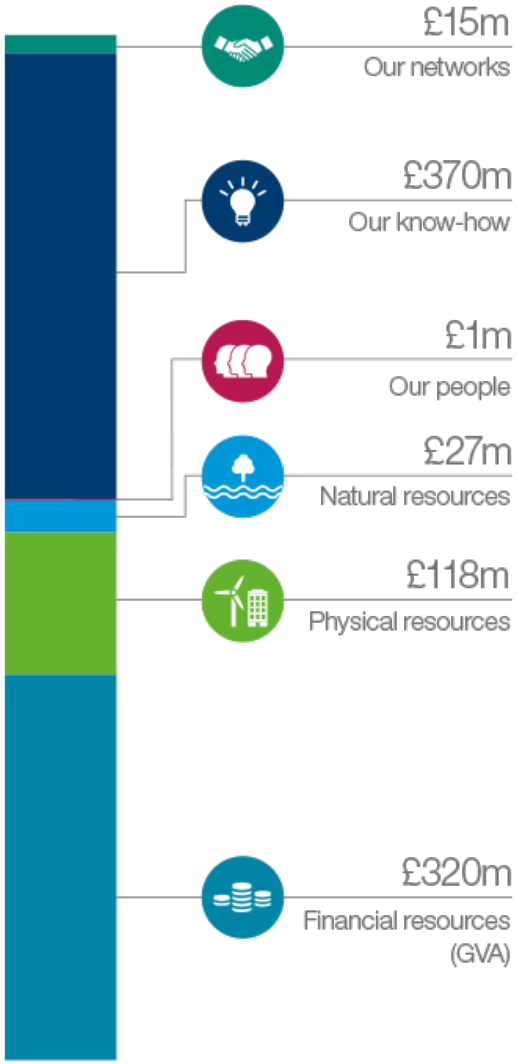
5.4 Aggregation

Our aim had always been to aggregate the year-on-year changes in the values of our capitals for the purpose of developing a Total Contribution performance trend line. Whilst the prime purpose of Total Contribution is to monitor the changes in the individual capitals year on year, aggregation of the data is of interest in terms of overall performance. We call the approach we have developed 'adjusted Gross Value Added' (aGVA). This is based on the conventional economic measure of added value i.e. Gross Value Added (GVA – net return minus the costs of goods and services purchased). See section 6 for more detail.

However, GVA does not provide a full picture of value, just a picture of the money flow. Therefore, Total Contribution is GVA (financial resources), plus or minus the net values of the other capitals. In summary, we:

- Take the data against each of our indicators and ascribe to them an economic value.
- Net off the positive and negative values for each capital to give an overall net value.
- Add or subtract these to or from our GVA (our financial resources).

This is illustrated in the bar chart opposite which gives our Direct aGVA based on the average of three years' data (2013/14 – 2015/16). It gives us the baseline point for our three year rolling average Total Contribution trend line for the future. Use of a rolling average enables us to add and remove indicators, as necessary, to reflect changes in our business activity and impacts. It helps to smooth out the spikes in the trend line. In a similar manner we aggregate aGVA for our indirect and enabled impacts.



All figures are rounded.

Part 2: Economic valuation detail

The following pages give more technical detail of our methodology:

- key concepts - capital stocks and flows, and aGVA
- how we approach calculation of value in the value chain
- how we calculate value for each indicator, and
- next steps

As we include more indicators in our approach, and refine the existing, these pages will be updated.

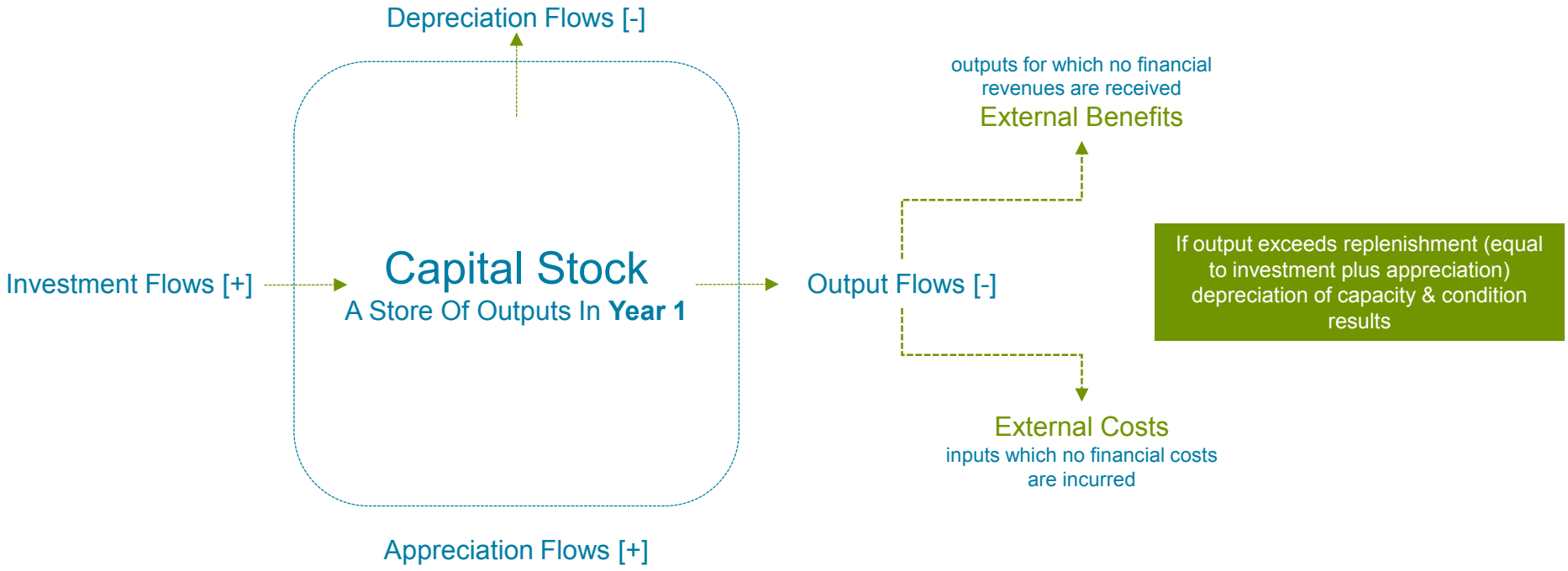
6. Key Concepts

6.1 Capital stocks and flows

The Crown Estate creates value from stocks of capital.

Capital stocks undergo quantitative and qualitative change throughout an accounting period. These changes can be described in terms of capital flows.
To establish a resilient business, the capacity and condition of all capital stocks should continually improve, i.e. respective positive flows should outweigh the negative flows.

Not all capital flows produced or consumed by The Crown Estate are exchanged in markets and represented in financial accounts.
Outputs for which no revenues are received are termed 'external benefits'.



6.2 Adjusted Gross Value Added (aGVA)

The new aggregate measure of Total Contribution is coined adjusted Gross Value Added (aGVA), and builds on conventional economic measures of added value.

Gross Value Added (GVA) is the conventional measure of an organisation's economic contribution. It is used in the estimation of a host country's Gross Domestic Product (GDP).

GVA at the organisation level can be calculated via two methods:

- Production Approach: economic value of outputs less economic value of intermediate inputs
- Income Approach: economic value of incomes earned by employees (i.e. wages) and owners (i.e. profits).

Net Value Added (NVA) equals GVA less 'consumption of fixed capital'.
Consumption of fixed capital concerns the decline, during the course of an accounting period, in the current value of the stock of fixed assets owned and used by a producer as a result of physical deterioration, normal obsolescence or normal accidental damage.

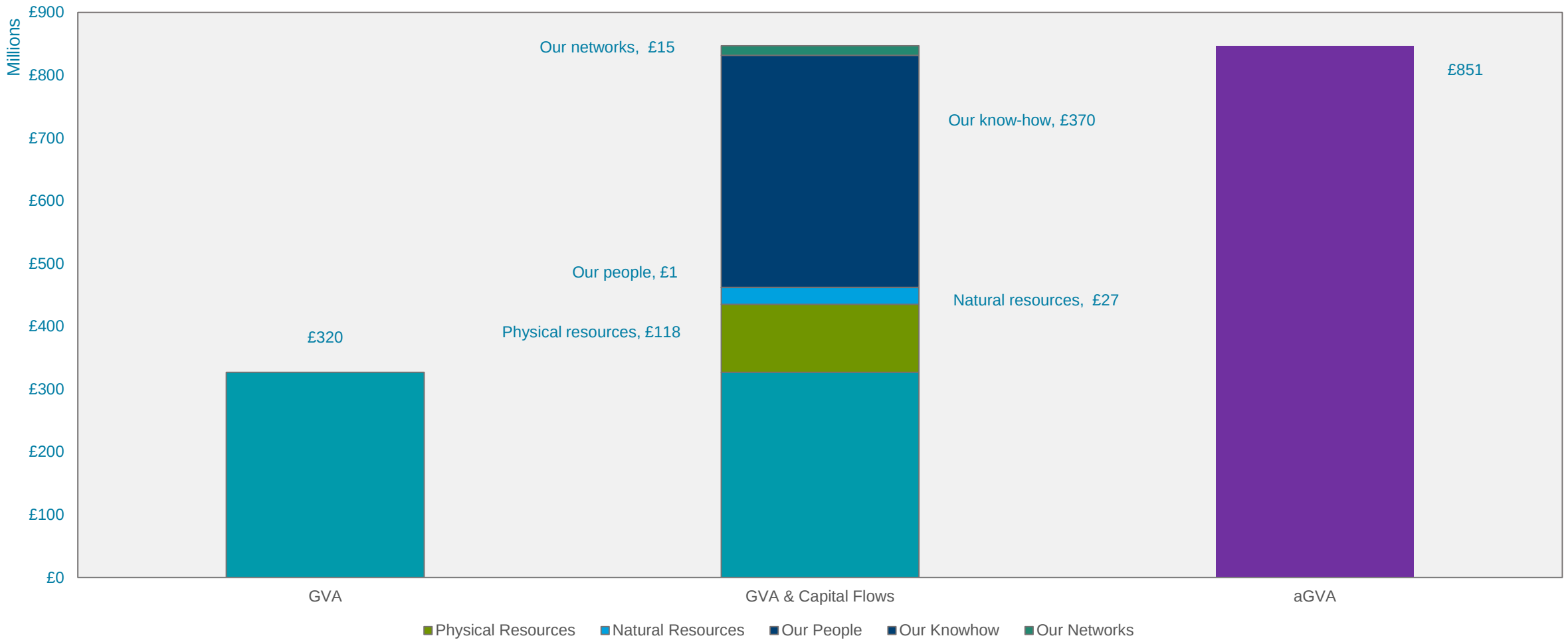
By extending the methods to calculate GVA and NVA, in order to capture an organisation's use of the full capital stock complement that is owned or 'borrowed', an aggregate measure of Total Contribution can be calculated – **adjusted Gross Value Added.**

There are three principal steps in calculating aGVA:

1. Reclassifying intermediate inputs
   For example, a training programme for employees, typically accounted for as an expense, is reclassified as an investment in knowhow / intellectual capital.
2. Performing economic valuation on all non-market capital flows
   Many inputs and outputs needed and resulting from business activities escape the market mechanism and thereby lack a financial cost and or benefit representation. By performing economic valuation on these 'non-market' flows, inputs can be translated into financial cost form and outputs can be translated into financial benefit form.
3. Introducing the economic value of all capital stock state changes, as represented by the capital flows,
   Through addition of benefits and deduction of costs to and from GVA, aGVA is calculated.

The following illustration shows The Crown Estate's direct aGVA, based on the average of three years' data (2013/14 – 2015/16). This constitutes the performance baseline and is the first point of a three year rolling average trend line.

‘adjusted Gross Value Added’ (aGVA):
Illustrative example using average of three years’ data (2013/14 – 2015/16)



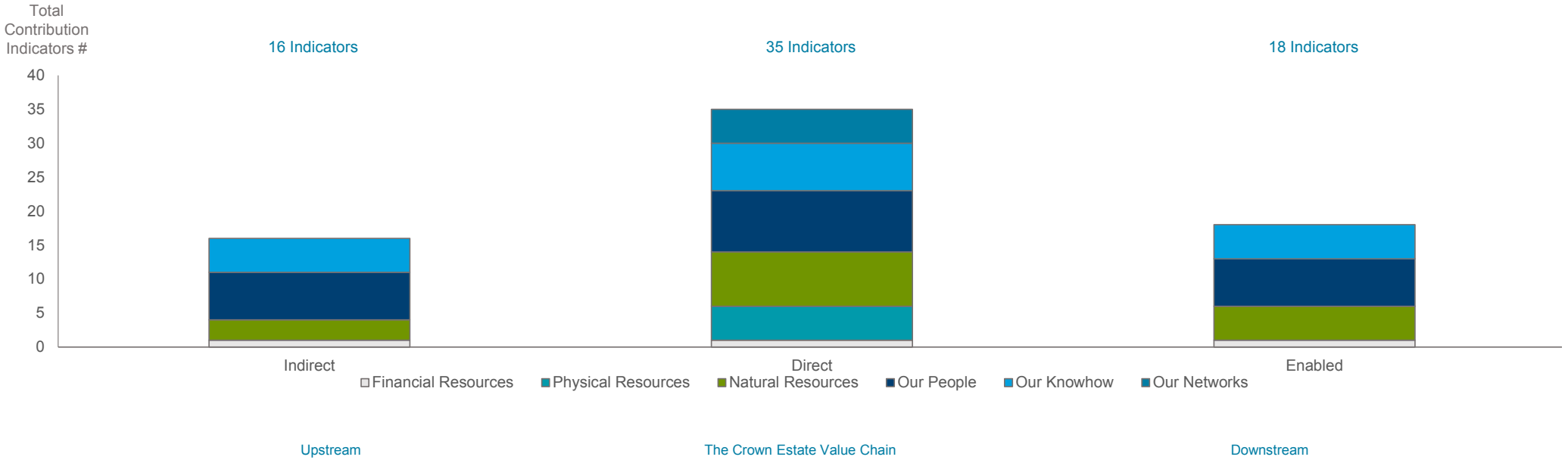
7. Value Chain

Total Contribution is calculated across The Crown Estate's value chain.

The value chain is interpreted as Direct (direct operations), Indirect (supply chain operations) and Enabled (customer operations):

- Direct concerns the Total Contribution resulting from activities carried out by The Crown Estate.
- Indirect concerns the Total Contribution of The Crown Estate's suppliers resulting from The Crown Estate's procurement.
- Enabled concerns the Total Contribution of The Crown Estate's customers resulting from The Crown Estate's lease of assets.

Of the 35 headline indicators featured in the Total Contribution report, not all are currently measured across the value chain. The table below illustrates indicator representation across the value chain. Over the coming years more balanced representation will be sought.



7.1 Indirect impacts

Indirect impacts relate to the Total Contribution of The Crown Estate's suppliers, resulting from The Crown Estate's procurement of goods and services.

Indirect Total Contribution is calculated by using an Extended Input-Output Analytical Table (EIOAT).

- The EIOAT is built by Route2 via extension of the conventional form, as published by UK Office of National Statistics.
  See: https://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables/datasets/ukinputoutputanalyticaltablesdetailed

- The EIOAT comprises 106 industry sectors and 300+ extensions.
  An example extension is tonnes of greenhouse gas released per industry sector per year.

- Input-output analysis performed on the EIOAT yields industry sector 'extension multipliers' - Direct, Indirect (First Tier, Second Tier, etc.) and Total (Direct plus Indirect) 'extension multipliers'.
  For example, the direct tonnes of greenhouse gases released per one million pounds of industry sector output.

- With extension multipliers calculated, all supply chain expenditures are assigned to one of the 106 EIOAT industry sector classifications.

- Total spend on each sector is then multiplied with each sector's extension multipliers to yield respective total extension value.
  For example, [X] tonnes of greenhouse gases released resulting from [Y] pounds of spend by The Crown Estate.

- The total extension values are subsequently introduced into the Total Contribution framework and methodologies.

7.2 Enabled impacts

Enabled Total Contribution concerns the Total Contribution of The Crown Estate's customers, resulting from The Crown Estate's lease of assets.

The basis for quantifying enabled Total Contribution is largely a three step process:

1. Classifying customer activities (e.g. crop production).
2. Determining scale of activities (e.g. crop production over 500 hectares).
3. Application of activity specific multipliers (e.g. greenhouse gases releases per hectare farmed).

See Appendices iii) and iv) for examples.

The key differences between enabled and indirect multipliers are:

- enabled multipliers are mostly physical intensities (i.e. per hectare, per M2 etc.) rather than financial intensities (i.e. per million pounds of output), and
- the enabled multipliers are derived from various techniques as opposed to a singular one (i.e. input-output analysis on extended tables).

Building Lease	Land Lease	Sea Bed Lease
Retail (M2) (FTE)	Crop Production (Ha.)	Aquaculture (Tones)
Industrial (M2) (FTE)	Animal Production (Ha.)	Gas Storage (M3)
Commercial / Office (M2) (FTE)	Timber Production (Ha.)	Pipelines (KM)
Residential (M2) (FTE)	Onshore Wind (MWh)	Cables (KM)
	Hydroelectric Power (MWh)	Offshore Wind (MWh)
	Extraction / Mining (Tonnes)	Wave & Tidal power (MWh)
	Pipelines (KM)	Extraction / Mining (Tonnes)

8. Calculation of individual indicators

- For each of the 35 direct Total Contribution indicators the following details are provided

Indicator Component	Component Description
Capital	The Capital Stock category to which the indicator belongs
Flow	The flow type which the indicator corresponds
Economic Value Description	An economic value based definition of the resulting change in the relevant capital stock's capacity and or condition
Calculation Steps	Details the data, information and calculative steps necessary to determine the economic value
Calculation Step Sources	The sources for the various data and information points
Key References	Published literature that underpins the indicator conception and economic valuation
Notes / Areas Of Improvement	Other information and where relevant explanation on how the indicator's economic valuation can be improved

8.1 Financial Resources

Financial Resources

1. Gross Value Added [GVA]

Indicator Component	Component Description
Capital	Financial resources
Flow	Output
Economic Value Description	The conventional measure of economic contribution
Calculation Steps	1. Establish Net Operating Profit before Depreciation, Treasury Agreements and Statutory Transfers minus Investment Revenue 2. Establish Employment Costs 3. The Sum of [1] plus [2] equals Gross Value Added [GVA]
Calculation Step Sources	Data relayed by The Crown Estate
Key References	---
Notes / Areas Of Improvement	---

8.2 Physical Resources

Physical Resources

2. New Development & Retrofitting

Indicator Component	Component Description
Capital	Physical resources
Flow	Investment
Economic Value Description	The economic benefit of constructing new properties and refurbishing existing properties (in terms of increased capacity or improved condition)
Calculation Steps	1. Establish total spend on new developments 2. Establish total spend on refurbishments 3. Sum of [1] plus [2] equals benefit of new development
Calculation Step Sources	Data relayed by The Crown Estate
Key References	---
Notes / Areas Of Improvement	- All supply chain spend (resulting from retrofits) informs the calculation of indirect Total Contribution

Physical Resources

3. Fixed Asset Upgrades

Indicator Component	Component Description
Capital	Physical resources
Flow	Investment
Economic Value Description	The economic benefit of improvements made to plant and equipment (in terms of increased capacity or improved condition)
Calculation Steps	1. Establish total spend on upgrades 2. [1] Equals benefit of upgrades
Calculation Step Sources	Data relayed by The Crown Estate
Key References	---
Notes / Areas Of Improvement	- All supply chain spend (resulting from all upgrades) informs the calculation of indirect Total Contribution

Physical Resources

4. Damage To Property Due To Workplace Activity

Indicator Component	Component Description
Capital	Physical resources
Flow	Depreciation
Economic Value Description	The economic cost of damage to properties through workplace incidents (in terms of reduced capacity or worsened condition)
Calculation Steps	1. Establish total spend on repairs or the value of associated insurance claims 2. [1] Equals cost of damage
Calculation Step Sources	Data relayed by The Crown Estate
Key References	---
Notes / Areas Of Improvement	- All supply chain spend (resulting from repairs) informs the calculation of indirect Total Contribution

Physical Resources

5. Wear & Tear of Fixed Assets

Indicator Component	Component Description
Capital	Physical resources
Flow	Depreciation
Economic Value Description	The economic cost of declining functionality of plant and equipment through use over time
Calculation Steps	1. Establish straight line depreciation value on plant and equipment 2. [1] Equals cost of wear and tear
Calculation Step Sources	Data relayed by The Crown Estate
Key References	---
Notes / Areas Of Improvement	---

Physical Resources

6. Reduction In Value Due To External Events (Natural, Social & Political)

Indicator Component	Component Description
Capital	Physical resources
Flow	Depreciation
Economic Value Description	The economic cost of damage to property, plant and equipment resulting from external events categorised as ‘natural’ (e.g. flood), ‘social’ (e.g. crime) and ‘political’ (e.g. new regulations restricting asset use or restricting wider activity) (in terms of reduced capacity or worsened condition)
Calculation Steps	1. Establish total spend on repairs or the value of associated insurance claims resulting from natural or social events 2. Establish value of reduced activity resulting from new regulations restricting use of an asset or wider commercial activity 3. Sum of [1] plus [2] equals cost of damage
Calculation Step Sources	Data relayed by The Crown Estate
Key References	---
Notes / Areas Of Improvement	- All supply chain spend (resulting from repairs) informs the calculation of indirect Total Contribution

8.3 Natural Resources

Natural Resources

7. Habitat Investment

Indicator Component	Component Description
Capital	Natural resources
Flow	Investment
Economic Value Description	The economic benefit of investments made in natural habitats (in terms of maintaining or enhancing the habitat's capacity to produce ecosystem services)
Calculation Steps	1. Establish total spend on habitat specific improvements (e.g. Windsor Estate parkland) 2. [1] Equals benefit of improvements
Calculation Step Sources	Data relayed by The Crown Estate
Key References	---
Notes / Areas Of Improvement	- Each habitat specific investment will have a varying impact on the quantitative and qualitative provision of ecosystem services (e.g. maintaining recreation opportunities, enhancing biodiversity etc.). Reflecting these variations through application of bespoke Social Returns on Investment [SROI] multipliers would represent significant improvement to the current method - All supply chain spend (resulting from such investment) informs calculation of indirect Total Contribution

Natural Resources

8. Soil Recovery Strategies

Indicator Component	Component Description
Capital	Natural resources
Flow	Investment
Economic Value Description	The economic benefit of soil replenishment resulting from inactive agricultural lands (in terms of enhancing capacity to produce ecosystem services)
Calculation Steps	1. Establish total income received from agricultural tenants 2. Establish total area of agricultural land leased 3. Establish total area of agricultural land not leased (i.e. classed 'void') 4. Divide [1] by [2] to yield average rental income per unit area 5. Multiply [4] with [3] to yield estimated lost income through voids 6. Use [5] as a proxy for economic benefit of soil recovery
Calculation Step Sources	Data relayed by The Crown Estate
Key References	---
Notes / Areas Of Improvement	- Soil conditions vary across agricultural lands. Further, recovery takes time. Reflecting the variations in condition, developing minimum time thresholds for recovery and further understanding and quantifying the ancillary ecological benefits (e.g. improved biodiversity) would represent significant improvement to the current method

Natural Resources

9. Greenhouse Gas Emissions

Indicator Component	Component Description
Capital	Natural resources
Flow	External Cost
Economic Value Description	The economic cost of releasing greenhouse gases into the atmosphere (in terms reducing atmospheric capacity to assimilate emissions and stabilise climate)
Calculation Steps	1. Estimate quantity of greenhouse gas emissions resulting from direct operations 2. Establish unit social cost per tonne of greenhouse gas released 3. Multiply [1] with [2] to yield economic cost of greenhouse gas emissions
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate Step 2 // Unit social cost of £ **[23.32]** per tonne carbon dioxide; published by **UK Government**
Key References	Step 2 // UK Government. *Carbon valuation collection* @ https://www.gov.uk/government/collections/carbon-valuation--2
Notes / Areas Of Improvement	- According to published research, the unit social cost deployed within Total Contribution is low within the available value range. A recent publication from Nature Climate Change suggests the social cost is £ **[131]** / Tonne @ http://www.nature.com/nclimate/journal/v5/n2/full/nclimate2481.html - The wide value range results (mostly) from differing model variables (e.g. impact type, impact time-frame, time-frame discount rate etc.)

Natural Resources

10. Waste Generated

Indicator Component	Component Description
Capital	Natural resources
Flow	External Cost
Economic Value Description	The economic cost of dis-amenity resulting from the final disposal methods of waste flows
Calculation Steps	1. Estimate the quantity of non-hazardous and hazardous waste resulting from operations 2. Estimate unit social costs of generating non-hazardous and hazardous waste 3. Multiply [1] with [2] to yield dis-amenity based economic cost of waste generated
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate Step 2 // Unit social costs of £ **[3]** per tonne non-hazardous (landfill) waste and £ **[21]** per tonne hazardous (incineration) waste; published by **UK Government**
Key References	Step 2 // UK Department for Environment, Food & Rural Affairs [DEFRA], *Evaluation of the external costs and benefits to health and environment of waste management options* @ http://webarchive.nationalarchives.gov.uk/20130123162956/http:/www.defra.gov.uk/environment/waste/research/health/pdf/costbenefit-valuation.pdf
Notes / Areas Of Improvement	- It's assumed the final destination for all non-hazardous waste is landfill. Similarly, incineration is the final destination for all hazardous waste - Including further impacts, such as contamination of groundwater via landfill and local air pollution via incineration, would represent significant improvement to the current method

Natural Resources
11. Water Consumed

Indicator Component	Component Description
Capital	Natural resources
Flow	External Cost
Economic Value Description	The economic cost of water consumption (in terms of reducing ground water capacity to serve wider societal and ecological needs)
Calculation Steps	1. Estimate the quantity of water consumed from operations 2. Estimate unit social cost of consuming one cubic metre of fresh water 3. Multiply [1] with [2] to yield economic cost of water (over) consumption
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate Step 2 // Unit replacement cost of £ **[1]** per cubic metre of fresh water, based on average desalination costs, is used as a proxy for the social cost
Key References	Step 2 // CETAQUA, *The economics of desalination for various uses* @ http://www.rac.es/ficheros/doc/00731.pdf
Notes / Areas Of Improvement	- The current method employs a unit replacement cost as a proxy for unit social cost. Further research is required to: (a) better understand where consumption exceeds groundwater recharge rates; and (b) the social cost, in terms of ecological damage, resulting from location specific over-abstraction and -consumption. Undertaking such research and incorporating the findings would represent significant improvement to the current method

Natural Resources

12. Carbon Sequestered & Stored

Indicator Component	Component Description
Capital	Natural resources
Flow	External Benefit
Economic Value Description	The economic benefit of absorbing greenhouse gas emissions (in terms of alleviating atmospheric capacity to assimilate emissions and stabilise climate)
Calculation Steps	1. Establish total forest area under The Crown Estate's management 2. Establish a sequestration factor per hectare of forest 3. Establish unit social cost per tonne of greenhouse gas released 4. Multiply [1] with [2] and then with [3] to yield economic benefit of sequestration
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate Step 2 // Sequestration factor of **[3.41]** tonnes carbon dioxide per hectare; distilled from datasets published by **UK Forestry Commission** Step 3 // Unit social cost of £ **[23.32]** per tonne carbon dioxide; published by **UK Government**
Key References	Step 2 // Forestry Commission, *Carbon sequestration* @ http://www.forestry.gov.uk/forestry/INFD-7M8FGE Step 3 // UK Government. *Carbon valuation collection* @ https://www.gov.uk/government/collections/carbon-valuation--2
Notes / Areas Of Improvement	- The current method views the UK's forest lands a single homogenous block, with all trees sequestering at the same rate. In reality, trees sequester at different rates according to geographic location, host soil conditions, age and species. Incorporating the varying rates would represent significant improvement to the current method - According to published research, the unit social cost deployed within Total Contribution is low within the available value range. A recent publication from Nature Climate Change suggests the social cost is £ **[131]** / Tonne @ http://www.nature.com/nclimate/journal/v5/n2/full/nclimate2481.html - The wide value range results (mostly) from differing model variables (e.g. impact type, impact time-frame, time-frame discount rate etc.)

Natural Resources

13. Greenhouse Gas Emissions Avoided

Indicator Component	Component Description
Capital	Natural resources
Flow	External Benefit
Economic Value Description	The economic benefit of avoiding the release of greenhouse gas emissions through use of renewable electrical power technologies (in terms of alleviating atmospheric capacity to assimilate emissions and stabilise climate)
Calculation Steps	1. Establish total amount of electricity generated from all renewable energy technologies 2. Establish an avoided greenhouse gas factor per kWh of electricity generated 3. Establish unit social cost per tonne of greenhouse gas released 4. Multiply [1] with [2] and then with [3] to yield economic benefit of avoided greenhouse gas emissions
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate Step 2 // Avoided factor of **[0.00043]** tonnes carbon dioxide per kWh; published by **Renewables UK** Step 3 // Unit social cost of £ **[23.32]** per tonne carbon dioxide; published by **UK Government**
Key References	Step 2 // Renewables UK @ http://www.renewableuk.com/en/renewable-energy/wind-energy/uk-wind-energy-database/figures-explained.cfm Step 3 // UK Government. *Carbon valuation collection* @ https://www.gov.uk/government/collections/carbon-valuation--2
Notes / Areas Of Improvement	- The avoided factor can be refined to reflect the declining role of coal and subsequent reduced carbon intensity of the UK's electrical power generation - According to published research, the unit social cost deployed within Total Contribution is low within the available value range. A recent publication from Nature Climate Change suggests the social cost is £ **[131]** / Tonne @ http://www.nature.com/nclimate/journal/v5/n2/full/nclimate2481.html - The wide value range results (mostly) from differing model variables (e.g. impact type, impact time-frame, time-frame discount rate etc.)

Natural Resources

14. Other Ecosystem Services

Indicator Component	Component Description
Capital	Natural resources
Flow	External Benefit
Economic Value Description	The economic benefit of recreation, amenity, carbon storage, agricultural production and coastal protection services produced from different land covers
Calculation Steps	1. Capture land holdings in Geographical Information System [GIS] format 2. Introduce inland GIS files to Route2's recreation, amenity, carbon storage, agricultural production ecosystem services model 3. Introduce coastal GIS files to Route2's coastal protection ecosystem services model
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate Step 2 // See Appendix i) Step 3 // See Appendix i)
Key References	Step 2 // Bateman et al., (2013) Bringing Ecosystem Services into Economic Decision making in the United Kingdom. Science. (341) Step 3 // Arkema et al., (2013) Coastal habitats shield people and property from sea level rise and storms. Nature Climate Change. (3)
Notes / Areas Of Improvement	

8.4 Our People

Our People

15. Contribution To Private Healthcare

Indicator Component	Component Description
Capital	Our people
Flow	Investment
Economic Value Description	The economic benefit of improving employee health and well-being (in terms of increased capacity or improved condition)
Calculation Steps	1. Establish spend on private healthcare programmes (e.g. health insurance, vaccinations etc.) 2. [1] Equals benefit of improvement
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate
Key References	
Notes / Areas Of Improvement	- All programmes will have different private and wider individual and social returns on their investment. Identifying and applying these return on investment multipliers to spend would represent a significant improvement to the current approach - All supply chain spend (resulting from such investment) informs calculation of indirect Total Contribution

Our People

16. Contribution To Public Healthcare

Indicator Component	Component Description
Capital	Our people
Flow	Investment
Economic Value Description	The economic benefit of improving employee health and well-being (in terms of increased capacity or improved condition)
Calculation Steps	1. Establish average income tax paid per full time employee at The Crown Estate 2. Establish number of full time employees at The Crown Estate 3. Estimate national health contribution as a proportion of income tax paid 4. Multiply [1] with [2] and then with [3] to yield economic benefit of contribution
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate Step 2 // Data relayed by The Crown Estate Step 3 // National health contribution equals approximately **[18]** per cent of total tax paid; published by **UK Public Spending**
Key References	Step 3 // UK Public Spending @ http://www.ukpublicspending.co.uk
Notes / Areas Of Improvement	- Identifying and applying a social return on investment multiplier to the isolated tax portion, to capture the wider societal benefit of the National Health Service, would represent an improvement to the current approach

Our People

17. Investment In Other Well Being Programmes

Indicator Component	Component Description
Capital	Our people
Flow	Investment
Economic Value Description	The economic benefit of improving employee health and well-being (in terms of increased capacity or improved condition)
Calculation Steps	1. Establish total hours of employee participation in defined well being programmes 2. Establish average hourly employment cost 3. Establish total direct investment in in defined well being programmes 4. Multiply [1] with [2] and then add [3] to yield economic benefit of improvement
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate Step 2 // Data relayed by The Crown Estate Step 3 // Data relayed by The Crown Estate
Key References	---
Notes / Areas Of Improvement	- Identifying and applying programme specific private and social return on investment multipliers to respective total investment spend would represent an improvement to the current approach - All supply chain spend (resulting from such investment) informs calculation of indirect Total Contribution

Our People
18. Workplace Injuries

Indicator Component	Component Description
Capital	Our people
Flow	Depreciation
Economic Value Description	- The economic costs of reducing employee health and well-being through workplace injury (in terms of reduced capacity or worsened condition)
Calculation Steps	1. Establish number of employees to suffer minor & major injuries 2. Establish number of days absent through minor & major Injuries 3. Establish average daily employment cost 4. Multiply [2] with [3] to yield base cost for minor & major injuries 5. Estimate individual welfare loss for minor & major injuries 6. Establish corporate compensation payments for minor & major injuries 7. Estimate corporate administration cost per injury (as a percentage of base cost [4]) 8. Estimate corporate replacement cost per minor & major injury (as a percentage of base cost [4]) 9. Estimate government administration cost per injury (as a percentage of base cost [4]) 10. Estimate government medical treatment cost per injury (as a percentage of base cost [4]) 11. Total corporate cost equals [7] plus [8] multiplied with [4] and then summed with [6] 12. Total individual cost equals [5] multiplied with [1] 13. Total government cost equals [9] plus [10] multiplied with [4] 14. Total cost equals [11] plus [12] plus [13]
Calculation Step Sources	Steps 1, 2, 3 & 6 // Data relayed by The Crown Estate Step 5 // Minor welfare loss equals £ **[300]** per person and major welfare loss equal £ **[20.500]** per person; published by **UK HSE** Steps 7 & 8 // Admin' cost equal to **[3]** per cent of base cost; replacement cost equal to **[10]** and **[41]** per cent, minor major, respectively; published by **UK HSE** Steps 9 & 10 // Admin' cost equal to **[10]** per cent of base cost; medical cost equal to **[63]** per cent; published by **UK HSE**
Key References	Steps 5, 7, 8, 9 & 10 // UK Health & Safety Executive @ http://www.hse.gov.uk/research/rrpdf/rr897.pdf
Notes / Areas Of Improvement	- The current method can be updated with unit costs (rather than application of percentages to a base cost) - Further, disaggregation by injury type with corresponding corporate, individual and societal costs would yield further insight

Our People

19. Workplace Fatalities

Indicator Component	Component Description
Capital	Our people
Flow	Depreciation
Economic Value Description	The economic cost of death resulting from workplace incident (in terms of reduced capacity)
Calculation Steps	1. Establish number of fatalities 2. Establish average annual employment cost per employee 3. Multiply [1] with [2] to yield base cost 4. Estimate corporate replacement cost (as a percentage of base cost [3]) 5. Estimate corporation fixed compensation cost per fatality 6. Estimate government fixed compensation cost per fatality 7. Multiply [4] with [3] and then add [5] and [6] to yield economic cost of fatality
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate Step 2 // Data relayed by The Crown Estate Step 4 // Replacement cost equals **[41]** per cent of average employment cost; published by **UK HSE** Step 5 // Corporate fixed compensation cost equal to £ **[790,000]** per fatality; **Route2 meta-analysis** Step 6 // Government fixed compensation cost equal to £ **[111,400]** per fatality; published by **UK HSE**
Key References	Steps 4 & 6 // UK Health & Safety Executive @ http://www.hse.gov.uk/research/rrpdf/rr897.pdf
Notes / Areas Of Improvement	- The current method can be updated with unit cost (rather than application of a percentage to a base cost)

Our People

20. Sickness Absence Days

Indicator Component	Component Description
Capital	Our people
Flow	Depreciation
Economic Value Description	The economic cost of sickness absence days (in terms of reduced capacity or worsened condition)
Calculation Steps	1. Establish number of short term sick days taken per year (i.e. not through serious illness) 2. Establish average daily employment cost per employee 3. Multiply [1] with [2] to yield base cost 4. Estimate corporate administration and replacement costs (as a percentage of base cost [3]) 5. Estimate individual medical and loss of household output costs as a percentage of base cost [3]) 6. Estimate government administration and medical costs (as a percentage of base cost [3]) 7. Multiply [4] with [3] to yield corporate cost 8. Multiply [5] with [3] to yield individual cost 9. Multiply [6] with [3] to yield government cost 10. Sum [7], [8] and [9] to yield total cost of sickness absence
Calculation Step Sources	Steps 1 & 2 // Data relayed by The Crown Estate Step 4 // Administration cost equals **[3]** per cent and replacement cost equals **[10]** per cent of base cost; published by **UK HSE** Step 5 // Medical cost equals **[3]** per cent and reduced output equals **[9]** per cent of base cost; published by **UK HSE** Step 6 // Administration cost equals **[10]** per cent and medical cost equals **[63]** per cent of base cost; published by **UK HSE**
Key References	Steps 4, 5& 6 // UK Health & Safety Executive @ http://www.hse.gov.uk/research/rrpdf/rr897.pdf
Notes / Areas Of Improvement	- The current method can be updated with unit costs (rather than application of percentages to a base cost)

Our People

21. Gender Equal Opportunity

Indicator Component	Component Description
Capital	Our people
Flow	Depreciation
Economic Value Description	The economic cost of reduced employee productivity resulting from perceived lack of development / progression opportunities for women employees
Calculation Steps	1. Establish total number of female employees and the total number of female employees operating at manager grade or above 2. Establish the total female manager numbers to total female employees ratio 3. Establish total number of male employees and the total number of male employees operating at manager grade or above 4. Establish the total male manager numbers to total male employees ratio 5. Divide [2] by [4] to establish the gender equal opportunity ratio [GEOR] 6. Apply fixed penalty if GEOR is less than defined threshold 7. Apply (linear) proportion of fixed penalty if GEOR is between threshold and equality
Calculation Step Sources	Steps 1, 2, 3 & 4 // Data relayed by The Crown Estate Step 6 // Fixed penalty of **[1.2]** per cent revenues and threshold equal to **[0.67]**; **Route2 meta-analysis** Step 7 // Linear penalty operates according to formula [[1-GEOR] / **[0.33]**] * **[1.2]**] per cent of revenues
Key References	Step 6 // Adler. (2009) Women in the Executive Suite Correlate to High Profits. European project On Equal Pay
Notes / Areas Of Improvement	- The current method can be updated with more recent research on the financial implications of gender inequalities

Our People

22. Employee Engagement

Indicator Component	Component Description
Capital	Our people
Flow	Appreciation
Economic Value Description	The economic benefit of enhanced employee productivity resulting from increased job-environment engagement (as reflected in reduced presenteeism and absenteeism).
Calculation Steps	1. Establish number of engaged employees [#] (Number of employees * employee engagement score %) 2. Establish average daily employment cost per employee 3. Days not lost to presenteeism due to engagement = [6.5] * Number of engaged employees (1) 4. Days not lost to absenteeism due to engagement = [1] * Number of engaged employees (1) 5. Avoided cost of lost days to presenteeism = Days not lost to presenteeism (3)* Average daily employment cost per employee (2) 6. Calculate the company indirect financial benefit of engagement, apply 'days not lost to presenteeism' (3) to engaged employees (1) 7. Calculate company indirect financial benefit of engagement, apply 'days not lost to absenteeism' (4) to the company financial cost of minor illnesses [£130] 8. Calculate individuals' non-financial benefit of engagement, apply 'days not lost to absenteeism' (4) to the individual's non-financial cost of minor illnesses [£320] 9. Calculate the individuals' direct financial benefit of engagement, apply 'days not lost to absenteeism' (4) to the individual's financial cost of minor illnesses [£90] 10. Calculate the government's direct financial benefit of engagement, apply 'days not lost to absenteeism' (4) to the government's medical treatment cost per minor illnesses [£30] 11. Direct economic value of employee engagement is 'days not lost to presenteeism' (3) added to 'company indirect financial benefit of engagement' (6)
Calculation Step Sources	Steps 1, 2, // Data relayed by The Crown Estate Steps 3 & 4 // Willis Towers Watson. '2012 Global Workforce Study.' (2012) Step 7, 8, 9 // UK Health and Safety Executive (2015/16) Step 10 // "How much have I cost the NHS?" The Guardian (2016)
Key References	Step 1& 2 // @ https://www.towerswatson.com/Insights/IC-Types/Survey-Research-Results/2012/07/2012-TowersWatson-Global-Workforce-Study Step 7, 8, 9 // @ http://www.hse.gov.uk/economics/eauappraisal.htm Step 10 // @https://www.theguardian.com/society/ng-interactive/2016/feb/08/how-much-have-i-cost-the-nhs
Notes / Areas Of Improvement	- Research shows that engaged employees show lower levels of presenteeism (being at work whilst not productive) and absenteeism. (1) 'Days not lost to presenteeism due to engagement' captures this by calculating the number of days of avoided presenteeism, while (2) 'Days not lost to absenteeism due to engagement' measures the number of days of avoided absenteeism. When applying the Sickness Absence Rate methodology to this indicator, the costs applied are those of 'Stress' and 'Minor Illness,' as these causes of absence are deemed to best reflect the causes of absence due to lack of engagement. Additional research on the non-financial individual benefit of being engaged at work would enhance the calculation.
Version Updated	- June 2018

Our People

23. Employee Volunteer Programmes

Indicator Component	Component Description
Capital	Our people
Flow	External Benefit
Economic Value Description	The economic benefit of employee (paid) time diverted to local community / societal (non-commercial) initiatives (in terms of improved condition)
Calculation Steps	1. Establish number of employee volunteer programme hours undertaken 2. Establish average hourly employment cost 3. Establish number of employee participants 4. Divide [1] by [3] to yield volunteer hours per volunteer participant 5. Estimate employee volunteer benefit hours threshold 6. Divide [4] by [5] to establish volunteering benefit factor 7. Estimate health benefit per employee volunteer (body and mind) 8. Estimate Social Return On Investment [SROI] factors for volunteer programmes 9. Multiply [1] with [2] to yield base benefit 10. Multiply [6] with [7] to yield individual benefit 11. Multiply [8] With [9] to yield wider societal benefit 12. Sum [10] & [11] to yield total benefit of employee volunteer programmes
Calculation Step Sources	Steps 1, 2 & 3 // Data relayed by The Crown Estate Step 5 // Threshold for the full manifestation of individual volunteer benefits equals **[100]** hours per year; published by **NCSC** Step 7 // Health benefits for body equal to £ **[2,357]** per volunteer and mind benefits equal to £ **[956]** per volunteer; published by **BoE** Step 8 // Average SROI equal to [200] per cent, published by **BoE**
Key References	Step 7 // Bank of England. In giving, how much do we receive? The social value of volunteering @ http://www.bankofengland.co.uk/publications/Documents/speeches/2014/speech756.pdf
Notes / Areas Of Improvement	- Further research on benefit thresholds and programme specific SROIs would represent improvements to the current approach

8.5 Our Know-how

Our Know-how

24. Employee Training & Development

Indicator Component	Component Description
Capital	Our know-how
Flow	Investment
Economic Value Description	The economic benefit of enhancing capabilities through formal and informal training & development programmes
Calculation Steps	1. Establish direct spend per specific training & development programmes 2. Establish total employee hours dedicated per training & development programmes 3. Establish average hourly employment cost 4. Multiply [2] with [3] and sum with [1] to yield total base benefit per training & development programme 5. Estimate return on investment multipliers [net] per training & development programme 6. Multiply [4] with [5] to yield total benefit of employee training & development programmes
Calculation Step Sources	Steps 1, 2 & 3 // Data relayed by The Crown Estate Step 5 // ROI multipliers synthesised via **Route2 meta-analysis**
Key References	Step 5 // Bartell. Measuring the Employer's Return On Investments in Training. Columbia University Step 5 // Almeida (2006)The Return to Firm Investment in Human Capital. Word Bank
Notes / Areas Of Improvement	- Further research on programme specific return on investment multipliers would represent significant improvements to the current approach - All supply chain spend (resulting from such investment) informs calculation of indirect Total Contribution

Our Know-how

25. Research & Development

Indicator Component	Component Description
Capital	Our know-how
Flow	Investment
Economic Value Description	The economic benefit of enriching knowhow through research & development activities
Calculation Steps	1. Establish direct spend on research & development [R&D] activities 2. Establish total employee hours dedicated to R&D 3. Establish average hourly employment cost 4. Multiply [2] with [3] and sum with [1] to yield total **base benefit** 5. Estimate private return on investment [ROI] multipliers to R&D expenditures 6. Estimate public / societal return on investment [ROI] multiplier to R&D expenditures 7. Multiply [5] plus [6] with [4] to yield total benefit of R&D activities
Calculation Step Sources	Steps 1, 2 & 3 // Data relayed by The Crown Estate Steps 5 & 6 // Private returns equal to **[30]** per cent & public returns equal to **[70]** per cent; published by **Frontier Economics**
Key References	Steps 5 & 6 // Frontier Economics (2014). Rates of return to investment in science and innovation @ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/333006/bis-14-990-rates-of-return-to-investment-in-science-and-innovation-revised-final-report.pdf
Notes / Areas Of Improvement	- Further research on and employment of activity specific return on investment multipliers would represent significant improvements to the current approach - All supply chain spend (resulting from such investment) informs calculation of indirect Total Contribution

Our Know-how

26. Knowledge Decay

Indicator Component	Component Description
Capital	Our know-how
Flow	Depreciation
Economic Value Description	The economic cost of technological knowledge obsolescence (i.e. the declining productivity of existing knowhow)
Calculation Steps	1. Establish number of full time employees classified as 'technical' 2. Establish average annual employment cost of technical employees 3. Using [1] & [2] calculate annual human capital stock value of technical employees 4. Estimate knowledge decay rate 5. Multiply knowledge decay rate [4] to annual human capital stock value of technical employees [3]
Calculation Step Sources	Steps 1 & 2 // Data relayed by The Crown Estate Step 3 // The calculation of human capital stock value largely follows the 'income approach' employed by the World Bank, OECD and UK ONS. A difference concerns work years. The Route2 approach deploys average tenure years rather than remaining average work years. See Appendix ii) for the human capital stock value equation, which details the aforementioned income approach in mathematical form. Step 4 // The decay rate is equal to **[13.6]** per cent, synthesised via **Route2 meta-analysis**
Key References	Step 3 // Fender (2012). Measuring The UK's Human Capital Stock. Office For National Statistics Step 4 // Park et al., (2006). Measurement of depreciation rate of technological knowledge: Technology cycle time approach. Journal of Scientific & Industrial Research. 60. pp 121 – 127; de Grip. (2004). Evaluating Human Capital Obsolescence. EC-OECD Seminar On Human Capital & Labour Market Performance; Hall. (2007). Measuring The Returns To R&D: The Depreciation Problem. National Bureau Of Economic Research Working Paper Series; Winfred et al., (1998) Factors That Influence Skill Decay & Retention. Human Performance. 11(1) pp 57 – 101
Notes / Areas Of Improvement	- Further research and deployment of more activity specific decay rates would represent improvement to the current approach

Our Know-how

27. Sub-Optimal Turnover Rates

Indicator Component	Component Description
Capital	Our know-how
Flow	Depreciation
Economic Value Description	The economic cost of deteriorating aggregate knowhow via excessive or stagnant employee voluntary turnover levels
Calculation Steps	1. Establish total employment costs 2. Establish voluntary employee turnover rate 3. Establish industry mean voluntary employee turnover rate 4. Subtract [2] from [3] to determine the sub optimal turnover rate 5. Multiply total employment costs [1] with sub-optimal turnover rate [4] to yield economic cost of any sub-optimal employee turnover level 6. Establish unit hiring & training cost (direct replacement cost) & unit lost productivity costs (indirect replacement cost) 7. Establish number of replacement employees recruited 8. Multiply replacement costs [6] with replacement employees [7] to yield cost of replacing leavers 9. Sum [5] and [8] to yield total cost of sub-optimal employee turnover
Calculation Step Sources	Steps 1, 2 & 3 // Data relayed by The Crown Estate Step 5 // The 'penalty' for the sub-optimal portion is devised via **Route2 meta-analysis** Step 6 // Direct and indirect replacement costs follow major injuries methodology; published by **UK HSE**
Key References	Step 5 // Bliss et al. (2016). The Business Cost and Impact of Employee Turnover
Notes / Areas Of Improvement	- Further research into and employment of findings concerning industry specific optimal turnover ranges and methods for estimating economic cost of sub-optimal rates would represent significant improvements to the current approach

Our Know-how

28. Value Added

Indicator Component	Component Description
Capital	Our know-how
Flow	Appreciation
Economic Value Description	The economic benefit of increased productivity resulting from application of unique know-how (for purposes of asset management)
Calculation Steps	1. Establish total property value for beginning of accounting period (i.e. 'opening value') 2. Establish total property value for end of accounting period (i.e. 'closing value') 3. Subtract [1] from [2] to establish total property value change for the accounting period 4. Establish value of purchases in accounting period 5. Establish value of development and other capital expenditure in accounting period 6. Establish market movements (using bespoke IPD industry benchmark) for accounting period 7. Subtract [4], [5] and [6] from [3] to yield The Crown Estate's outperformance, attributed to unique knowhow (if relevant), for the accounting period
Calculation Step Sources	Steps 1, 2, 4 & 5 // Data relayed by The Crown Estate Step 6 // IPD Industry Benchmark published by **MSCI**
Key References	Step 6 // IPD Industry Benchmark @ https://www.msci.com/real-estate
Notes / Areas Of Improvement	- Better understanding the drivers of outperformance and subsequent refinement of the 'value added' value to reflect pure appreciation in know-how would represent an improvement to the current approach - See Appendix 3 for diagrammatic representation of calculation

Our Know-how

29. Production Of Public Information Goods

Indicator Component	Component Description
Capital	Our know-how
Flow	External Benefit
Economic Value Description	The economic benefit of information goods and services produced for public consumption (for free)
Calculation Steps	1. Establish the cost of production in both direct & indirect (dedicated employee hours) 2. Estimate time taken for production in years 3. Divide [1] by [2] to yield annual value of public information good provision
Calculation Step Sources	Steps 1, 2 & 3 // Data relayed by The Crown Estate
Key References	---
Notes / Areas Of Improvement	---

Our Know-how

30. Consumption Of Public Information Goods

Indicator Component	Component Description
Capital	Our know-how
Flow	External Cost
Economic Value Description	The economic cost of information goods and services consumed (for free) (specifically open source software)
Calculation Steps	1. Establish number of personal computers 2. Estimate the economic value of open source software per personal computer 3. Multiply [1] with [2] to yield annual value of public information good consumption
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate Step 2 // Unit value of £ **[398]** per computer sourced from **Route2 meta-analysis**
Key References	---
Notes / Areas Of Improvement	---

8.6 Our Networks

Our Networks

31. Customer Management Systems

Indicator Component	Component Description
Capital	Our networks
Flow	Investment
Economic Value Description	The economic benefit of improved customer relationships
Calculation Steps	1. Establish direct & indirect expenditure on customer relationship management [CRM] systems 2. [1] equals customer management systems
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate
Key References	---
Notes / Areas Of Improvement	- Understanding, quantifying and tracking the strength of relationships would represent a significant improvement to the current approach. To this end, The Crown Estate has commenced a routine customer survey / feedback process in order to establish a benchmark of relationship strength. - Translating improvement in relationships to economic value is relatively straightforward and commonplace once a benchmark has been established - All supply chain spend (resulting from such investment) informs calculation of indirect Total Contribution

Our Networks

32. Stewardship Programme

Indicator Component	Component Description
Capital	Our networks
Flow	Investment
Economic Value Description	The economic benefit of improved relationships with the local community
Calculation Steps	1. Establish direct spend per stewardship programmes 2. Establish total employee hours dedicated per stewardship programme 3. Establish average hourly employment cost 4. Multiply [2] with [3] and sum with [1] to yield total base benefit per stewardship programme 5. Estimate social return on investment [SROI] multipliers per stewardship programme 6. Multiply [4] with [5] to yield total benefit of stewardship programmes
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate Step 5 // Programme specific SROI multipliers synthesized via **Route2 meta-analysis**
Key References	Step 5 // e.g. The Finance Project. Measuring Social Return on Investment for Community Schools @ http://www.childrensaidsociety.org/files/CASE%20STUDY%20final.pdf
Notes / Areas Of Improvement	- Further research and employment of programme specific return on investment multipliers would represent improvement to the current approach - All supply chain spend (resulting from such investment) informs calculation of indirect Total Contribution

Our Networks

33. Late Payment Of Suppliers

Indicator Component	Component Description
Capital	Our networks
Flow	Depreciation
Economic Value Description	The economic cost of declining relationship with suppliers resulting from late payment of invoices
Calculation Steps	1. Establish The Crown Estate's total spend / procurement 2. Establish the percentage of suppliers paid late (i.e. beyond invoice terms) 3. Estimate the average number of late days (i.e. days beyond invoice term until invoice paid] 4. Establish average interest rate on short term overdraft facility 5. Multiply [1] with [2] then with [3] (divided by days in the year) and finally with [4] to yield economic cost of late payments
Calculation Step Sources	Steps 1 & 2 // Data relayed by The Crown Estate Step 3 // Estimated **[10]** late days synthesised via **Route2 meta-analysis** Step 4 // Average interest rate estimated at **[3.2]** per cent, sourced from **Money Supermarket**
Key References	---
Notes / Areas Of Improvement	- Further research and refinement of the number of late days would represent an improvement to the current approach

Our Networks

34. Employee Placements

Indicator Component	Component Description
Capital	Our networks
Flow	Appreciation
Economic Value Description	The economic benefit of securing employment for the unemployed
Calculation Steps	1. Establish number of employee placements 2. Establish minimum wage 3. Multiply [1] with [2] to yield total employee placement individual income 4. Establish fiscal gain per placement 5. Establish economic gain per placement 6. Sum [4] & [5] then multiply with [1] to establish wider benefits of total placements 7. Sum [3] & [6] to establish total benefit of employee placements
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate Step 2 // Data on minimum wage published by **UK ONS** Step 4 // Fiscal gain equal to £ **[6,900]** per placement; published by **Joseph Rowntree Foundation** Step 5 // Economic gain equal to £ **[14,000]** per placement; published by **Joseph Rowntree Foundation**
Key References	Steps 4 & 5 // Bivand & Simmonds. (2014). The benefits of tackling worklessness and low pay. Joseph Rowntree Foundation
Notes / Areas Of Improvement	- The application of these placement multipliers is likely to yield an overestimate of benefits. Further research on employment issues concerning deadweight, substitution and displacement would represent an improvement to the current approach

Our Networks

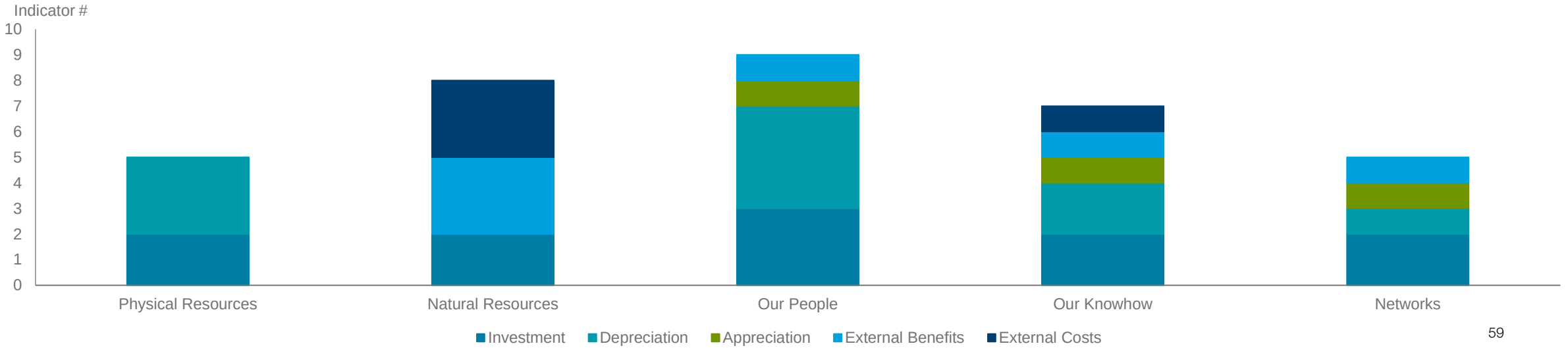
35. Well Being

Indicator Component	Component Description
Capital	Our networks
Flow	External Benefit
Economic Value Description	The economic benefit of the recreational opportunities delivered by the Windsor Estate to local and wider communities
Calculation Steps	1. Capture Windsor Estate land holdings in GIS format 2. Introduce Windsor Estate GIS files to Route2's recreation, amenity & carbon storage ecosystem services model 3. Distil the recreation economic value 4. Allocate recreation value [3] to well being
Calculation Step Sources	Step 1 // Data relayed by The Crown Estate Step 2 & 3 // See Appendix
Key References	Step 2 // Bateman et al., (2013) Bringing Ecosystem Services into Economic Decision making in the United Kingdom. Science. (341)
Notes / Areas Of Improvement	- The Crown Estate has since evolved two areas that can better reflect the economic value of individual well being gains resulting from visits to the Windsor Estate. The first is improved and more routine estimation of total visitor numbers per year. Already these estimations suggest an increasing numbers of visitors. Up to a congestion point, the increasing numbers imply a higher absolute recreational and well being value is being derived from the estate. The second is the design of a choice experiment survey. The choice experiment seeks to (a) understand the estate's relative standing against similar UK estates; and (b) identify the key features of the Windsor Estate that attracts visitors.

9. Balance of Indicators

- The following table and chart illustrate the numbers of indicators, by capital and flow type, that currently inform Direct Total Contribution
- ‘Our people’ is currently populated by the most indicators
- The aim is to achieve greater balance, in particular greater representation in ‘Our networks’

	Investment	Depreciation	Appreciation	External Benefits	External Costs	TOTAL INDICATORS
Physical resources	2	3	-	-	-	5
Natural resources	2	-	-	3	3	8
Our people	3	4	1	1	-	9
Our know-how	2	2	1	1	1	7
Our networks	2	1	1	1	-	5



10. Next Steps

- Total Contribution shows promise as a tool to enrich day-to-day business decision making and help guide broader strategy
- The following areas of application and refinement have been identified to help realise this potential
  - Asset Management Tool
    - To prove the utility of Total Contribution in a decision making capacity, the core methods are being shaped into an Asset Management Tool [AMT]. The AMT will quantify and compare the Total Contribution of individual property assets (e.g. a retail park) and help inform future buy-hold-sell decisions
  - Stock Assessment & Economic Valuation
    - Total Contribution is a methodology developed to demonstrates the value The Crown Estate creates for the UK. A focus on value creation can draw attention away from the capacity and condition of the responsible foundations, the capital stocks. A resilient business, one which can continue to create value, must maintain and preferably enhance the capacity and condition of the capital stocks it depends on. To monitor capacity and condition, routine capital stock assessment and economic valuation is required
  - Indicator Strengthening
    - A number of the indicators require more refined data inputs and further research on their associated economic values. The priority indicators are those with a low internal confidence score (of '3') as detailed in methodology document
  - Indicator Balance
    - As highlighted in slides [5] and [53] indicator representation is not even across the value chain or the capital flow categories. To develop a level of methodological stability in and acceptability of the evolution in indicators and methods from the initial report, focus has been trained on Direct Total Contribution (which The Crown Estate can influence) and development of indicators that employ more accessible data (which The Crown Estate can also influence). Once stability and acceptability has been largely achieved, the intention is to achieve greater balance

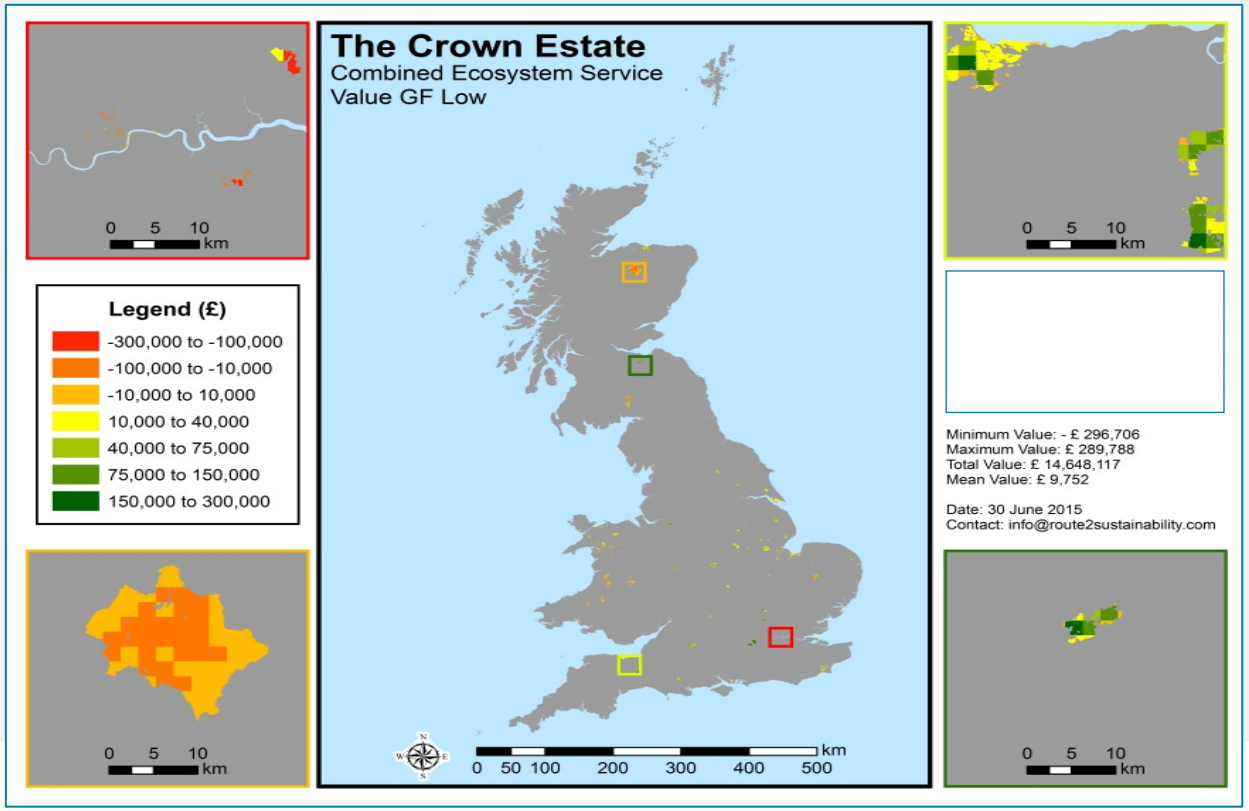
Appendices

Appendix i)

Ecosystem Services

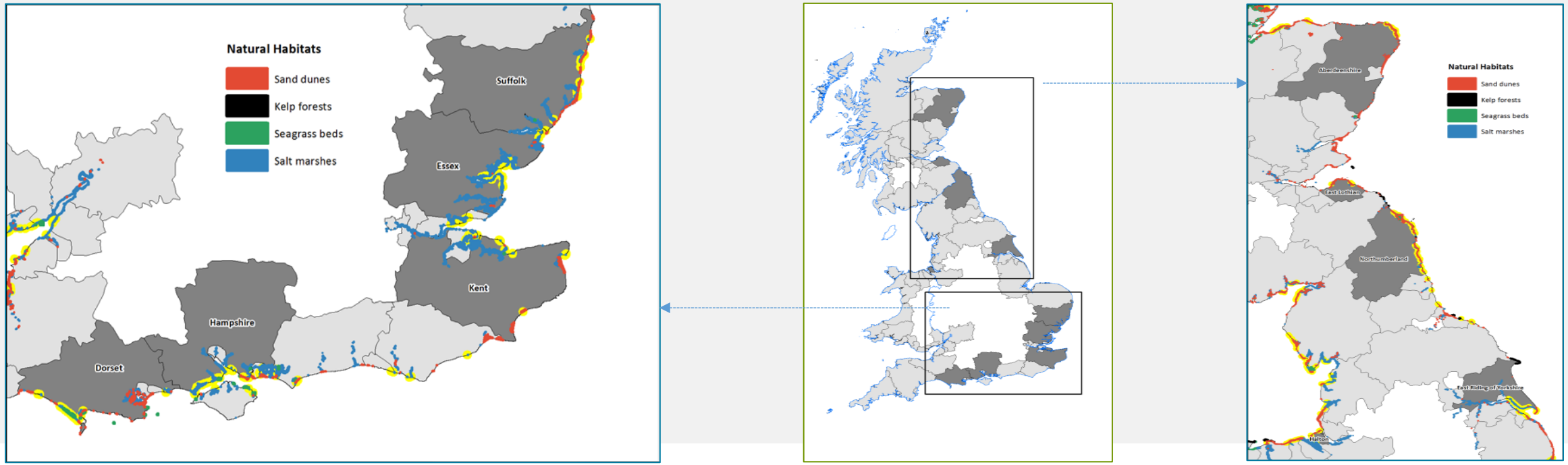
Rural Portfolio

- Based On The Work:
  - Bateman et al., 2013, Bringing Ecosystem Services Into Economic Decision Making: Land Use In The UK. Science. (341)
- Modeling Approach Summary:
  - To estimate ecosystem service values for the Crown Estate's rural portfolio we utilized the state of the art approach used by the UK's National Ecosystem Assessment [NEA]. The NEA used a mix of econometric, regression and biophysical process models to arrive at spatially-explicit monetary values for green-house gas emissions/sequestration, recreation, urban green space, and agricultural production (Bateman et al. 2013). Annual ecosystem service values were imputed by annualizing the difference in ecosystem service values between the years 2010-2060. The 2060 values were derived from future land cover distributions under a variety of scenarios representing a range of possible futures.
- Example Outputs:



Ecosystem Services
Coastal Portfolio

- Based On The Work:
  - Arkema et al., (2013) Coastal habitats shield people and property from sea level rise and storms. Nature Climate Change. (3)
- Modeling Approach Summary:
  - Integrated Valuation of Ecosystem Service and Tradeoffs (InVEST) is a suite of modeling tools that map, measure and value the goods and services humans receive from nature. InVEST enables decision-makers to assess the tradeoffs associated with alternative policy options, and to identify areas where investment in ecosystem services can enhance human development and conservation of terrestrial, freshwater, and marine ecosystems. InVEST models are also spatially explicit. They take both spatial and non-spatial inputs and produce maps and summary metrics that can be used for information and communication purposes. The report “Risk Reduction Provided by Natural Habitats to Great Britain’s Coastal Assets & People” describes in greater detail the mechanics of the InVEST coastal vulnerability model used in this study, as well as data sources, validation, limitations and assumptions.
- *Example Outputs:*



Appendix ii)

Human Capital Stock

Lifetime Income Economic Value Equation (Adapted)

$$K_{h\&i} = \sum_{t=1}^{T} L\, w\, (h-1)\, (1+r)^{-t}$$

Where:

$K_{h\&I}$	=	Human & Intellectual Capital
h	=	$Ae^{\emptyset n}$
L	=	Number of Full Time Employees [FTEs]
w	=	Wage Rate
A	=	Health Status per FTE = e^{pv}
v	=	Adult Survival Rate
p	=	Proportional Effect of Survival Rate On Human Capital
n	=	Years of Schooling Per FTE
ϕ	=	Rate of Return to Years of Education
r	=	Discount Rate
t	=	Time Horizon

With reference to the schooling and health components of the equation: (i) *schooling* - data on average years of schooling per working-aged person are obtained from Barro and Lee for 144 countries from 1970 to 2010 by five-year age groups[1]; (ii) *returns to education* – a uniform rate of 8.5 per cent is used[2] ; (iii) *survival rate* - is formulated as one minus the Adult Mortality Rate [AMR], where AMR is the probability that the average 15-year-old will dies before the age of 60. Currently experience is omitted from the formulation; and (iv) *returns to health* - a benchmark value of 0.65 is taken meaning that an increase of 10 percentage points in the survival rate is associated with a 6.5 percent increase in human capital. The time-period employed for the present value calculation is the average years a worker is expected to remain in employment (i.e. average tenure). Consistent with Route2's Natural Capital economic valuation the social discount rate of 4 per cent rate is used. Finally, to account for volatility in 'rental prices' for labour (i.e. wage rates), where possible annual wage rates are taken as a five-year lagged average.

[1] http://www.barrolee.com/data/dataexp.htm
[2] http://documents.worldbank.org/curated/en/2012/08/16603648/heterogeneous-returns-education-labor-market

Appendix iii)
Enabled Greenhouse Gas Emissions

Building Lease	Factor	Sources	Land Lease	Factor	Sources	Sea Bed Lease	Factor	Sources
Retail (M2)	0.08 Tonnes CO2e / M2 of Floor Area	**Centre For Sustainable Energy [1]**	Crop Production (Ha.)	5.18 Tonnes CO2e / Ha	**UK Government [2]**	Aquaculture (Tones)	Further research required	
Industrial (M2)			Animal Production (Ha.)	4.45 Tonnes CO2e / Ha		Gas Storage (M3)	Further research required	
Commercial / Office (M2)			Timber Production (Ha.)	Further research required		Pipelines (KM)	Further research required	
Residential (M2)			Onshore Wind (MWh)	Further research required		Cables (KM)	Further research required	
			Hydroelectric Power (MWh)	Further research required		Offshore Wind (MWh)	Further research required	
			Extraction / Mining (Tonnes)	Further research required		Wave & Tidal power (MWh)	Further research required	
			Pipelines (KM)	43 Tonnes / KM	**Interstate Natural Gas Association of America [3]**	Extraction / Mining (Tonnes)	Further research required	

[1] http://www.cse.org.uk/projects/view/1259#Display_Energy_Certificate_data
[2] https://www.gov.uk/government/collections/agriculture-in-the-united-kingdom
[3] Combination of fugitive methane, carbon dioxide from methane oxidation and carbon dioxide leakage @ http://www.ingaa.org

Appendix iv)
Enabled Mineral Waste Generation

Indicator Component	Component Description
Resource & Relationship / Capital	Natural
Flow	External Cost
Economic Value Description	- The economic cost of waste resulting from the extraction of minerals
Calculation Steps	1. Establish quantity of land won minerals extracted 2. Estimate unit waste factors (i.e. tonnes of waste per tonne of land won mineral extracted) 3. Multiply [1] with [2] to yield quantity of waste generated from land won minerals 4. Establish waste generated from sea won aggregates 5. Establish the proportion of [4] landfilled 6. Estimate unit social cost per tonne of waste generated 7. Multiply [6] with [3] and [5] to yield economic value of minerals waste generated
Calculation Step Sources	Steps 1, 4 & 5 // Data relayed by The Crown Estate Step 2 // Waste 'hidden' flow factors derived from Materials Flow Analysis, published by **British Geological Survey** Step 6 // Unit social costs of £ **[3]** per tonne non-hazardous (landfill) waste published by **UK Government**
Key References	Step 2 // British Geological Society. MineralsUK @ https://www.bgs.ac.uk/mineralsuk/ Step 6 // UK Department for Environment, Food & Rural Affairs [DEFRA] Evaluation of the external costs and benefits to health and environment of waste management options @ http://webarchive.nationalarchives.gov.uk/20130123162956/http:/www.defra.gov.uk/environment/waste/research/health/pdf/costbenefit-valuation.pdf
Notes / Areas Of Improvement	- Further research into the unit waste factors and developing more ecological specific unit social costs would represent significant improvement to the current approach