EUCALC

Explore sustainable European futures

Expert consultation on scenarios for land-use, water & biodiversity impacts

Pre-read document for the workshop

Wednesday 19th – Thursday 20thSeptember 2018

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730459.

Table of Contents

1 Agenda

Expert consultation on

The future of land use, water and biodiversity in Europe

Wednesday, 19th September 2018, from 12.00 noon to 5.30pm
Thursday, 20th September 2018, from 10.00am to 3.00pm
(British Summer Time - BST)

Imperial College London | South Kensington Campus |

London | United Kingdom

Day 1: Wednesday, 19th September 2018 **Royal School of Mines (RSM): Room G01**	
Time	**Activity**
12:00 – 12:30	**Registration and light lunch**
12:30 – 12:50	**Opening & welcome -** *Workshop agenda, objectives, participants introduction* **Dr. Jeremy Woods**, Imperial College London **Jonathan Buhl**, 4sing (facilitator)
12:50-13:10	**Presentation of the EUCalc project**- *Short overview presentation followed by clarifying questions and brief discussion* **Dr. Jeremy Woods**, Imperial College London **Garret Kelly**, SEE Change Net
13:10 – 13:50	**Reflections on food security, land use and climate change challenge -** *keynote presentation followed by questions and discussion* **Tom Heap**, BBC Rural Affairs Correspondent
13:50– 14:05	**Coffee/tea break**
14:05 – 14:40	**Background to land use, water and biodiversity module of the EUCalc** *Short overview presentation on the methodology, assumptions and levers* **Dr. Gino Baudry** and **Dr. Onesmus Mwabonje**, Imperial College London **Prof. Rachel Warren** and **Dr. Jeff Price**, University of East Anglia
14.40 – 16.00	**Interactive dialogue and discussion on critical questions**
16:00– 16:15	**Coffee/tea break**
16.15 – 17.10	**Interactive dialogue (continued)**
17:10 - 17:30	**Closing -** *Summary and key takeaways*
19.00 - 21.00	**Dinner** *(optional)*

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Day 2: Thursday, 20th September 2018 **Royal School of Mines (RSM): Room G41**	
Time	**Activity**
10:00 – 10:30	**Welcome coffee/Registration**
10:30 – 10:45	**Opening -** *1st day takeaways, objectives of the 2nd day* **Dr. Onesmus Mwabonje**, Imperial College London **Prof. Rachel Warren**, University of East Anglia **Jonathan Buhl,**4sing (facilitator)
10:45-11:30	**European and global perspective on land use, water and biodiversity impacts-** *keynote presentations followed by questions and discussion* **Prof. Dr. Ad De Roo**, European Commission, Joint Research Centre, Directorate D – Sustainable Resources, D2 - Water and Marine Resources Unit **Dr. Keith Kline**, ORNL - Oak Ridge National Laboratory, USA
11:30 – 11:45	**Levels of ambition and scenarios of the Land use, water and biodiversity module of the EUCalc** - *Short overview presentation* **Prof. Rachel Warren** and **Dr. Jeff Price**, University of East Anglia **Dr. Gino Baudry** and **Dr. Onesmus Mwabonje**, Imperial College London
11:45– 12:00	**Coffee/tea break**
12:00 – 13:50	**Interactive dialogue and discussion on the levels of ambition and scenarios**
13:50 - 14:00	**Closing -** *Summary and conclusion, final reflections and outline of next steps by the EUCalc team*
14:00 – 15:00	**Lunch and departure**

For additional information please contact:

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2 About the European Calculator

2.1What is a Calculator?

The Calculator approach consists of a multi-sectoral systems model associated with a web-tool that allows users to explore the options for reducing GHG emissions from now to 2050, and to see the consequences of these choices on multiple sustainability issues. To this end, users are enabled to control levers, expressing behaviour, technology or practice patterns among the different sectors, which affects the GHG emission trajectory, and a range of sustainability impacts. The first Calculator was developed in 2009 (UK 2050 Calculator[1]) to enable the UK Government to develop their greenhouse gases (GHG) emission mitigation strategy, namely the UK Carbon Plan. Since then, more than 30 Calculators[2] have been developed worldwide so far, with a few others already in process. These calculators can be used for informing policy making; designing GHG mitigation strategies; reporting on the Intended Nationally Determined Contributions (INDCs); education and research purposes; disseminating knowledge; and contributing to the climate change debate more broadly.

Building on the success of some early national 2050 calculators, the Global Calculator[3] was developed, which was led by the former UK Department of Energy and Climate Change (DECC), and co-funded by Climate-KIC, involving several world leading institutions in the project. The Global Calculator enables users to explore the options for reducing global greenhouse gas (GHG) emissions associated with land, food and energy systems in the period to 2050. The Global Calculator also extends the approach used in the country level 2050 calculators by illustrating the detrimental impacts of climate change associated with global-level choices.

2.2What is the European Calculator?

The European Calculator (EU-Calc)[4]is an ongoing project supported by the EU Horizon 2020 Programme, which builds on the expertise of these existing calculators. The project is led by PIK-Potsdam (Germany), involving several other European institutions. The EU-Calc aims to enable expert and non-expert users to explore multiple possible decarbonisation pathways for each EU Member States and Switzerland. Following the Calculator Philosophy, it will be:

- Published in full open access;
- Engineering-based model (similar to a system dynamics model) designed for scenario testing;
- User friendly through a web interface for expert and non-expert users;
- A tool assessed by external experts and stakeholders.

[1] The original UK 2050 Calculator is available at: http://classic.2050.org.uk

[2] See the full list of completed calculators with links to access them at: www.2050.org.uk/calculators

[3] The Global Calculator is available at: www.globalcalculator.org

[4] More information on the EU-Calc is available on its project's website at: www.european-calculator.eu

EU-Calc is targeting a wide range of stakeholders who are willing to contribute towards a low-carbon society, including (non-exhaustively) European and national policymakers, Government officials, private companies, NGOs and the civil society. In addition, the model aims to relevantly balance the scientific soundness, an intermediate level of complexity, and transparency. The base model has been built by using *KNIME (software / programming integration platform), MS Excel* and *Python*. The EU-Calc tool will be presented in the form of a user-friendly web tool, with a simple, highly dynamic interface, including links to further information for those who wish to explore more about the model (i.e. complexity on demand), all in public domain.EU-Calc also aims to empower users with the means to explore a very broad range of multiple possible low-carbon transformation pathways for Europe by 2050, and envision future sustainable development strategies.

2.3The role of co-design in EU-Calc

EU-Calc addresses multi-dimensional and inter-disciplinary issues, which requires a wide range of expertise to develop the tool. Decision-support tools are mostly shaped by highly disciplinary and technically deep scientific debates and have often omitted the input of key stakeholders. It is for this reason, that the EU-Calc embeds a co-design process with stakeholders and experts, organised through workshops for each main module (see Figure 1). Through this process, stakeholders are involved to shape and calibrate the EU-Calc tool by helping co-design the determinants and the scope of the scenarios.

3 Land Use, Water & Biodiversity

3.1Module integration in EU-Calc

Imperial College is leading the Land-use, Water and Biodiversity areas of the EU Calc project in collaboration with University of East Anglia (UEA), PIK-Potsdam, Climact, T6ECO, TU Delft, SEE Change Net and Climate Media Factory. Land-use, water and biodiversity impacts are computed based on the lifestyle patterns from now to 2050, that affect the demand for specified food types e.g. bovine meat, cereals, wine, etc; transportation by mode e.g. demand for cars, public transport; buildings e.g. area per capita, heating demand; and manufactured products e.g. resulting in a demand for steel, wood, and so on. Figure 1 shows the integration among the main sectors modelled in the calculator.

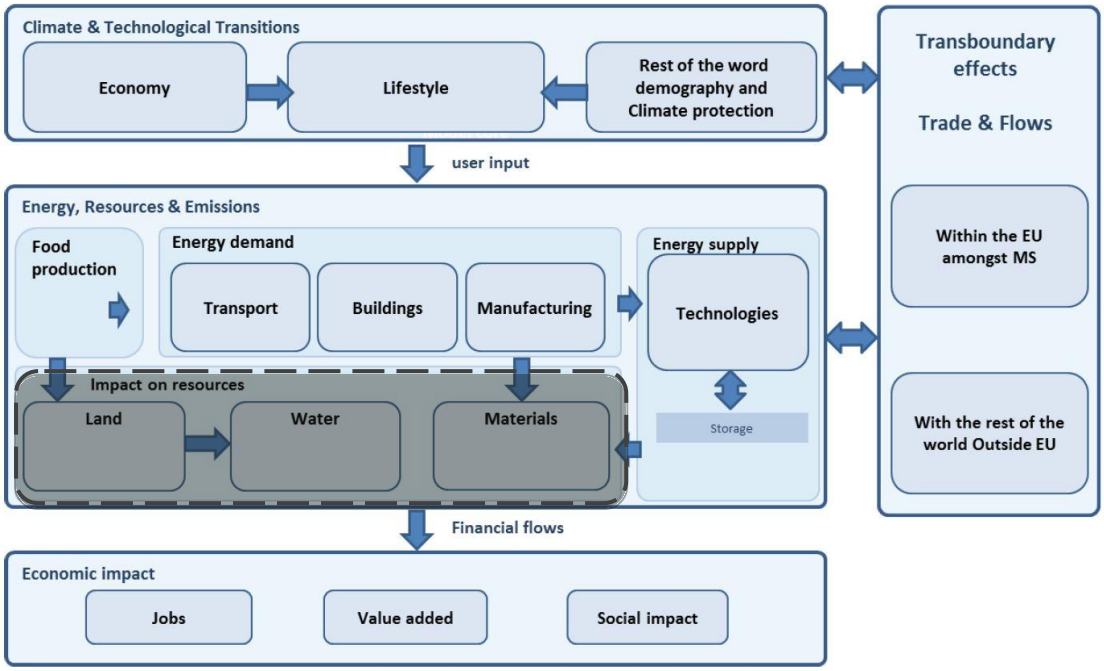

Figure 1 – Overview of the EU-Calc structure

The land-use, water & biodiversity module is dedicated to compute the impacts of meeting these demands in terms of GHG emissions mitigation, energy demand, land-demand and their associated land-use, water and biodiversity impacts. The extent of these impacts will depend on the choices users make when designing their own pathways.

3.2Modelling approach

The land-use, water & biodiversity module consists of a dozen sub-sectors that enables the computing of the impacts associated with the supply of food, bioenergy, biomaterials, and minerals (illustrated in Figure 2):

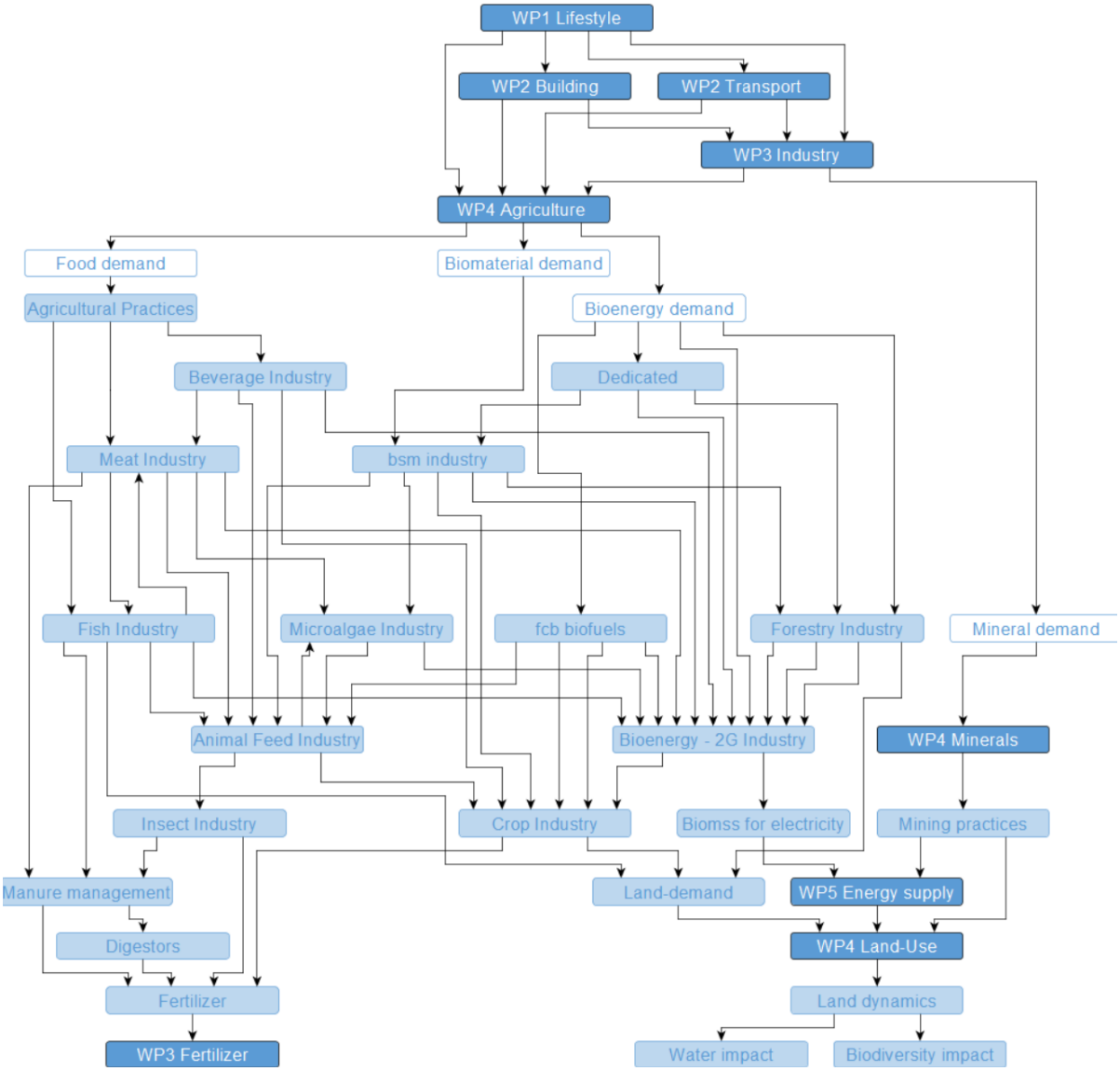

Figure 2 – Overview of the module structure

3.3Module scope& granularity

Table 1 presents the main sectors, inputs and outputs of the model.

Table 1 – Scope of the land-use, water & biodiversity module

Sectors	Inputs	Outputs
Meat & livestock	Demand for Bovine, Mutton & Goat, Pig, Poultry meat; Offal; Animal Fats; Eggs; Milk products	Cattle by type; meat volume by type; manure volume; animal fats by type; meat, bone & blood meals; pasture demand; feed demand by type; energy demand; water demand.
Fishery & aquaculture	Demand for Freshwater Fish; Demersal Fish; Pelagic Fish; Other aquatic animals; Demand for fish-based meals (feed)	Fishery volumes (human food & animal feed); Inland water demand; feed demand by type; energy demand; water demand.
Beverage industry	Demand for Wine; Beer; Fermented Beverages; Distilled beverages; Coffee and Tea.	Beverage volumes, crop demand by type; supply of cereal-meals, grape marc, coffee marc; energy demand; water demand.

Sectors	Inputs	Outputs
Insect farming	Demand for insect-based meals; Organic waste supply;	Insect-meals volume, land-demand, energy demand; water demand; feed demand (possibly); manure/fertilizer supply;
Food crop-based bioenergy	Demand for bioenergy (dedicated crops)	Production volumes; Energy-demand; Water-demand; Land-demand; Feed meal supply;
Animal feeding & diets	Feed demand by type (cereals, grains, roughage, meat-meals, sugar-meals, oilseeds meals, insect-based meals, microalgae-based meals)	Feed volumes, demand for crop by type.
Biomaterials	Demand for biomaterial by type (wood, oil, ethanol, hemp, microalgae, fibre crops)	Production volumes; crop-demand by type; wood demand by type; microalgae biomass demand;
Forestry	Demand for wood by type	commercial forest demand; supply of wood residues;
Waste & residues bioenergy	Demand for bioenergy; Supply of wastes & residues (from feed, food, biomaterial demand)	Production volumes; Energy-demand; Water-demand;
Microalgae biorefinery	Demand for microalgae-based meals, microalgae biomass (biomaterial), and possibly microalgae bioenergy	Microalgae-meal volume, land-demand, energy demand; water demand; fertilizer demand/supply; energy supply by-type;
Crop production	Demand for food crops by types (from feed, food, bioenergy, biomaterial demand): Cereals, Oil crops, Pulses, Starchy Roots, Sugar & Sweeteners, Fruits, Vegetables, Vegetable oils	Production volumes (including wastes); Supply of agricultural residues; Fertilizer demand; Energy-demand; Water-demand;
Manure management	Supply of manure (insect, livestock, aquaculture)	Production volumes; Manure disposed; GHG emissions; Manure applied in soil (fertilizer); Manure supply for digestors;
Digestors	Manure supply; Waste supply (food, urban, agro)	Production volumes; Fertilizer supply; Energy-supply; Water-demand;
Organic Fertilizer	Fertilizer demand; Fertilizer supply (agro-food industry by-products, digestate)	Production volumes; Ammonia-based fertilizer demand;
Mineral	Mineral demand by type (Iron-ore, cement, limestone, sand, clay, gypsum, rare earth materials)	Production volumes; energy-demand; Water-demand; land-use demand;
Land-use	Land-demand by type/use	Land-use & dynamics; Land-cropping or land-surplus; Carbon soil dynamics;
Biodiversity	Ambition based on Aichi Objectives	Degraded lands; protected lands & inland water; fish stocks;

4 Workshop scope

The objective of the present Workshop is to co-design key features of EU-Calc, as described below (see also Table 2):

- Identifying the most critical emission-driving levers (Depth 1);
- Practices associated with each lever may also be defined and challenged (Depth 2);
- Defining how ambitious the levers' levels are (Depth 3).

Table 2 – Scope of the co-creation process

Levers *Depth 1*	**Practices** *Depth 2*	**Ambition levels** *Depth 3*
Identify the relevant determinants to mitigate GHG emissions E.g. Agriculture practices	Identify the practices or actions (if relevant) E.g. Organic farming; Agroforestry; and so on.	Define the potential by 2050 through 4 ambition levels for each practice E.g. Organic farming by 2050 can be 100% as a level 4

4.1Levers

Table 3 presents the levers of the Land-Use, Water and Biodiversity module, that represent changes we could achieve by 2050 that would mitigate climate change.

Table 3 – Scope of the co-creation process

Levers	**Units**	**Short description**
Agricultural practices	%	Agriculture practices affect meat and crop supply, and the extent of land, water, fertilizer, energy demand, biodiversity impacts and their associated GHG emissions. *Practices:* Organic farming, agroforestry, urban agriculture, conservation agriculture, precision agriculture, multiple cropping.
Fishery Practices	%	Fishery practices affect fisheries and aquaculture, and the extent of inland, water, fertilizer, energy demand, biodiversity impacts and their associated GHG emissions. *Practices:* Aquaculture/wild catches, bycatches, discards, ghost fishing, fuel mix;
Forestry practices	%	Forestry management practices affect the supply of woody biomass, and the extent of the harvesting intensity, fertilizer-demand, land-demand, energy demand, carbon sequestration, and the biodiversity impacts. *Practices:* Sustainable Forest Management, Ecosystem-based Management
Type of animal feed (diet)	%	Animal feeding practices affect the diets of livestock and fish from aquaculture. The feed types affect the extent of the associated impacts in terms of land-use, water-use, energy-demand and the by-products types. *Animal Diets:* cereal meals, grain meals, roughage, insect meals, microalgae meals, animal fats, meat & bone meals, fish meals, oil fish meals.
Biomass availability	hierarchy	Biomass availability is setting a hierarchy to prioritize the use of biomass and by-products for bioenergy and for biomaterials for papers products, building materials etc. compared with the other uses (food, feed, pet-food, fertilizer, compost). *Hierarchy:* GHG emissions efficiency, energy efficiency, economic efficiency, enabling or disabling dedicated crops for non-food biomass.
Waste & residues	%	The lever sets the waste generation and waste and residues collection rates for the module (agriculture, fishery, forestry, food industry). *Parameters:* ambition in terms of waste mitigation and collection rates by waste types;
Mining	%	Consistent with the previous levers, the mineral module sets the

Levers	Units	Short description
Practices		mining practices to supply minerals, and thus, the extent of the associated impacts in terms of land-use, water-demand, energy-demand, possible deforestation & reforestation. *Practices:* ambition regarding energy-use & mix, water-use, land-use, wastes, chemical-use, mine site restoration.
Land management practices	%	The lever sets the land management practices including the allocation of land-surplus, the prevention of land-degradation (erosion, soil fertility decline, salinization, and so on); *Practices:* ambition regarding land degradation & desertification practices; afforestation, reforestation, protecting soil from wind and water erosion, green walls;
Biodiversity protection practices	%	The lever sets practices to protect and prevent biodiversity erosion, for example, with an emphasis on the Strategic Plan for Biodiversity (the Aichi Target[5]). It requires land savings for protecting areas, also affecting the water availability.

4.2 Levels of ambition

Similar to the existing calculators, for each lever, 4 levels of ambitions can be set to express the extent of the emission reduction effort that could be achieved from 2015 until 2050. In order to be consistent across the different sectors of EU-Calc, Table 4 presents how the lever setting should reflect the 4 levels of ambition. This Table is illustrated by the '*bioenergy yield lever*', extracted from the Global Calculator. Yields gain are mainly covered by a share of higher energy efficiency feedstock.

Table 4– Levels of ambition in EU-Calc framework

Level	Business as usual
1	This level contains projections that are aligned and coherent with the observed trends. *Bioenergy yield lever illustration [unit: tonnes/ha]:* *Low yield increase. Total increase by 20% by 2050.*

Level	Ambitious but achievable
2	This level is an intermediate scenario, more ambitious than business as usual but not reaching the full potential of available solutions. *Bioenergy yield lever illustration [unit: tonnes/ha]:* *Moderate yield increase. Total increase by 50% by 2050*

Level	Very ambitious but achievable
3	This level is considered very ambitious but realistic, given the current technology evolutions and the best practices observed in some geographical areas. *Bioenergy yield lever illustration [unit: tonnes/ha]:* *High yield increase. Total increase by 120% by 2050*

[5] For more information, see: https://www.cbd.int/sp/targets/

Level	Transformational breakthrough
4	This level is considered as transformational and requires additional breakthrough and efforts such as a very fast market uptake of deep measures, an extended deployment of infrastructures, major technological advances, or strong societal changes, etc. *Bioenergy yield lever illustration [unit: tonnes/ha]:* *Extreme yield increase. Total increase by 200% by 2050*

4.3Discussion items

Scope of analysis

- Is our scope of analysis sufficient for the proposed approach?
- Should we add other relevant food or by-product categories?

Day 1 - How can we move towards a more sustainable society?

Levers (Depth 1)

- Do you agree with the selection of proposed levers? Do you think our choice of levers is coherent and comprehensive enough?
- Are there any other important levers missing on the list? Are there irrelevant levers you think we should remove from the list? Please note that EU-Calc will have several levers for the other sectors (e.g. energy, transport, buildings etc.), too, and we expect that the maximum number of levers should not be more than approximately 40 levers in total (all sectors); otherwise, the calculator may sound too difficult or confusing for an ordinary user.

Practices & their associated impacts (Depth 2)

- Do you agree with the selection of practices?
- Are there any other important practices missing on the list? Are there irrelevant practices you think we should remove from the list?
- Are the scope and range of the practice impacts well covered?
- Is there an innovative practice/solution that you think would make a positive change or a major disruption?

Day 2 – How fast can we move towards a more sustainable society?

Ambition levels & future scenarios (Depth 3)

- Do you agree with the levels of ambition in each of the levers?
- What are the main trends for the different practices by 2050? Does the model allow enough flexibility to take them into account?
- What is the pace of technological, behavioural and practices change?

5 Practical Information

5.1Reimbursement Form

Please find attached the Expenses forms for non-Imperial College staff. Please note that this form is to repay individuals and NOT companies. Original receipts should be attached (no scans or photocopies) and credit card slips are not accepted (please see Policy for further rules attached).

Please ensure that you write your bank details correctly and remember to sign the form. Completed forms should be sent to Dr Jeremy Woods (PI) (email: jeremy.woods@imperial.ac.uk) for approval.

5.2Information about venue

- **How to find the Royal School of Mines at Imperial College**

The workshop will be held in the Royal School of Mines. This is building number 12 in the top right corner of the South Kensington campus map. The best entrance to the building is via Prince Consort Road from Exhibition Road.

If you get lost or you're running late, please contact Onesmus Mwabonje to let us know: **+44(0)7884437045**.

You can find directions to our South Kensington campus below. The College main entrance is on Exhibition Road, but you can access the Royal School of Mines' building directly via the Prince Consort Road, see full address below.

- **Address**

Royal School of Mines,
Imperial College London,
Prince Consort Road,
London, SW7 2BP.

- **How to find us**

The nearest Underground station is **South Kensington**, on the District, Circle and Piccadilly lines. From the station to the College you may take about 10-15 minutes walking.

- You may wish to plan your underground route with the Transport for London's journey planner: https://tfl.gov.uk/plan-a-journey/

- **From London City Airport**

Take the DLR to Canning Town, then by Underground, Jubilee line to Green Park and the Piccadilly line to South Kensington (journey time about 40 minutes).

- **From Heathrow airport**

Heathrow Express, about 15 min to Paddington mainline station, then the Underground, Circle line to South Kensington.

Or take the Underground, Piccadilly Line to South Kensington station (about 50 minutes travelling time, with several stops but no connections).

- **From Gatwick airport**

Gatwick Express, about 30 mins to Victoria mainline station, then by Underground, District or Circle lines to South Kensington.

Or take a national rail train to Victoria station (journey time 40 minutes) and then by Underground, Circle or District Line; westbound to South Kensington.

- **From Stansted airport**

Stansted Express, 50 mins to Liverpool Street main line station, and then by Underground, Circle line to South Kensington.

Heathrow, Gatwick and Stansted airports are some distance from London and a taxi is not recommended for the whole journey. However, if you have to travel by taxi, please establish the cost before you get in.

- **By sea**

Take a British Rail train from the port of entry to London (Harwich to London journey time 1hr 30 mins; Dover to London journey time up to 2hrs) and then travel by Underground to South Kensington Station.

- **On foot**

From South Kensington Station, the campus is only a ten minute walk. Either follow the subway signposted to the museums or walk outside north up Exhibition Road. The College is next to the Science Museum.

- **By bus**

South Kensington Campus is easily accessible by bus. A number of routes pass within easy walking distance of the campus. Transport for London's bus route maps: https://tfl.gov.uk/maps/bus

- **By car**

Car parking at South Kensington Campus is severely restricted and you are advised NOT to bring a car unless permission has been given. The car park is open to the public from 18.00 to Midnight on weekdays and from 08.00 to Midnight on weekends. Please note that overnight parking is not permitted. Parking in the streets surrounding the College is at pay and display or parking meters for limited periods only.

The postcode to use for satellite navigation to the South Kensington car park is **SW7 2BX**. Entry is via Exhibition Road.

6 Information Sheet

In advance of attending the workshop we would like to outline our joint understanding of how the workshop will be conducted and how information from it will be used. We take these issues seriously so please take time to read and understand the following. Please let us know in case of any concern. We will ask you to sign a copy of the consent form (overleaf) at the workshop.

I consent to be participant in the Expert Consultation Workshop on Scenarios for land-use, water & biodiversity impacts, to co-design a novel climate, energy and resources model under the framework of the EUCalc project, in London, on 19th and 20thSeptember 2018 based on the principles outlined below.

During this workshop, a group of approx. 25 frontline experts from public, private, civil society sectors and academia will come together to share their perspectives and discuss main land-use, water & biodiversity impacts and indicators of climate change mitigation in Europe. The workshop programme (attached) is designed to stimulate interactive knowledge exchange and we welcome your active participation and contribution to this group effort.

The EUCalc project team assures you that we will only record information that is necessary to address the central purpose of our research. While your name and organisation will be acknowledged on the list of participants, your inputs and contribution will not be attributed and will only appear in de-identified form in the publications/reports arising from this research. Anonymity of your input will at all times be safeguarded, except where you have consented or specified otherwise. This principle will be applied effectively on social media sites such as Twitter. Pictures taken at the workshop may be used inside project reports and could be used for the project website (http://www.european-calculator.eu/) and project presentations.

I understand that if at any time during the Workshop I feel unable or unwilling to continue, I am free to leave without negative consequences. That is, my participation in this Workshop is completely voluntary, and I may withdraw from this project at any time.

Co-design is one of the central components of the EUCalc project and we thank you for your willingness to participate. As a benefit of participating we would like to highlight an opportunity to be involved in a significant piece of research, to make connections with other prominent experts and to shape the EUCalc. The EUCalc team is also committed to the continued collaboration and exchange with workshop participants, including opportunities for subsequent feedback and access to early releases of the EUCalc. On the other hand, collected information will be stored internally and managed by the EUCalc partners under strict rules defined to safeguard anonymity of your inputs and alleviate any potential participation burdens such as harm for misuse of your identifiable information.

I have been informed that if I have any questions seeking further clarification or assurances about the ethical issues relating to the project, I am free to contactOnesmus Mwabonje (email: o.mwabonje@imperial.ac.uk)or Gino Baudry (email: g.baudry@imperial.ac.uk).

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Informed Consent Form

EU CALC - Pathways for a sustainable Europe
Expert workshop on Land-Use, Water and Biodiversity
Date: 19th – 20thSeptember 2018
Venue: Imperial College London

I …… agree to participate in Expert workshop on Land-Use, Water & Biodiversity.

The purpose of the Workshop has been explained to me in writing.

I am participating voluntarily and understand that I can withdraw from the research project, without repercussions, at any time, before it starts or while I am participating.

I am satisfied that the assurances of responsible and strict data governance, given by the *European Calculator projec*t, will be upheld.

I understand that my name and organisational affiliation will appear as a workshop participant, but that anonymity of participants' contributions will be ensured at each research stage in the project, unless otherwise agreed.

I agree that pictures taken at the workshop may be used inside project reports and could be used for the project website (http://www.european-calculator.eu/) and project presentations.

A copy of the information sheet and (this) signed consent form will be given to the signee.

Signature:…….

Participant's name:…….

Date:……..