The Open Sustainability Project: a Linked Data Approach to LCA

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A better way?

What can happen when a field opens up:

Wikipedia – Harnessing collective intelligence to develop an encyclopedia that surpasses the Encyclopedia Britannica in several years.

Sourcemap - Making and Visualizing supply chains for everyone

FoldIt – Using the problem solving skills of non-academics to solve academic problems – In this case, finding optimal protein folding structures

Open Data

freely available to the public without restrictions to view and use

why? allows for more rapid progress of knowledge, tools, and results

Linked Data

stored in a semantic, machine-readable format

Linking data together by describing relationships between objects/concepts/everything

why? linked data is easier to find and connects seamlessly to other data

Collective Intelligence

proposing a problem or task that would normally be limited to private sector or academic realms to the public

why? the search for a solutions benefits from more contributors and different/unusual approaches

OS.I OPEN SUSTAINABILITY (dot) INFO

We want sustainability information to be open, free and easy to use

http://opensustainability.info

First Steps…
Get data online in a machine-readable format

First Steps… Create an ontology

For Example - Geography

ISO 14041

5.3.6 **Data quality requirements**

"geographical coverage: geographical area from which data for unit processes should be collected to satisfy the goal of the study (e.g. local, regional, national, continental, global);"

ISO/TS 14048

"one set of data fields for Valid geography (1.1.8) as information used to describe the geographical coverage of the data (see ISO 14041:1998, 5.3.6), expressed by:

- unlimited number of data fields for the Area name (1.1.8.1, nomenclature 7.3);

- one data field for the Area description (1.1.8.2);

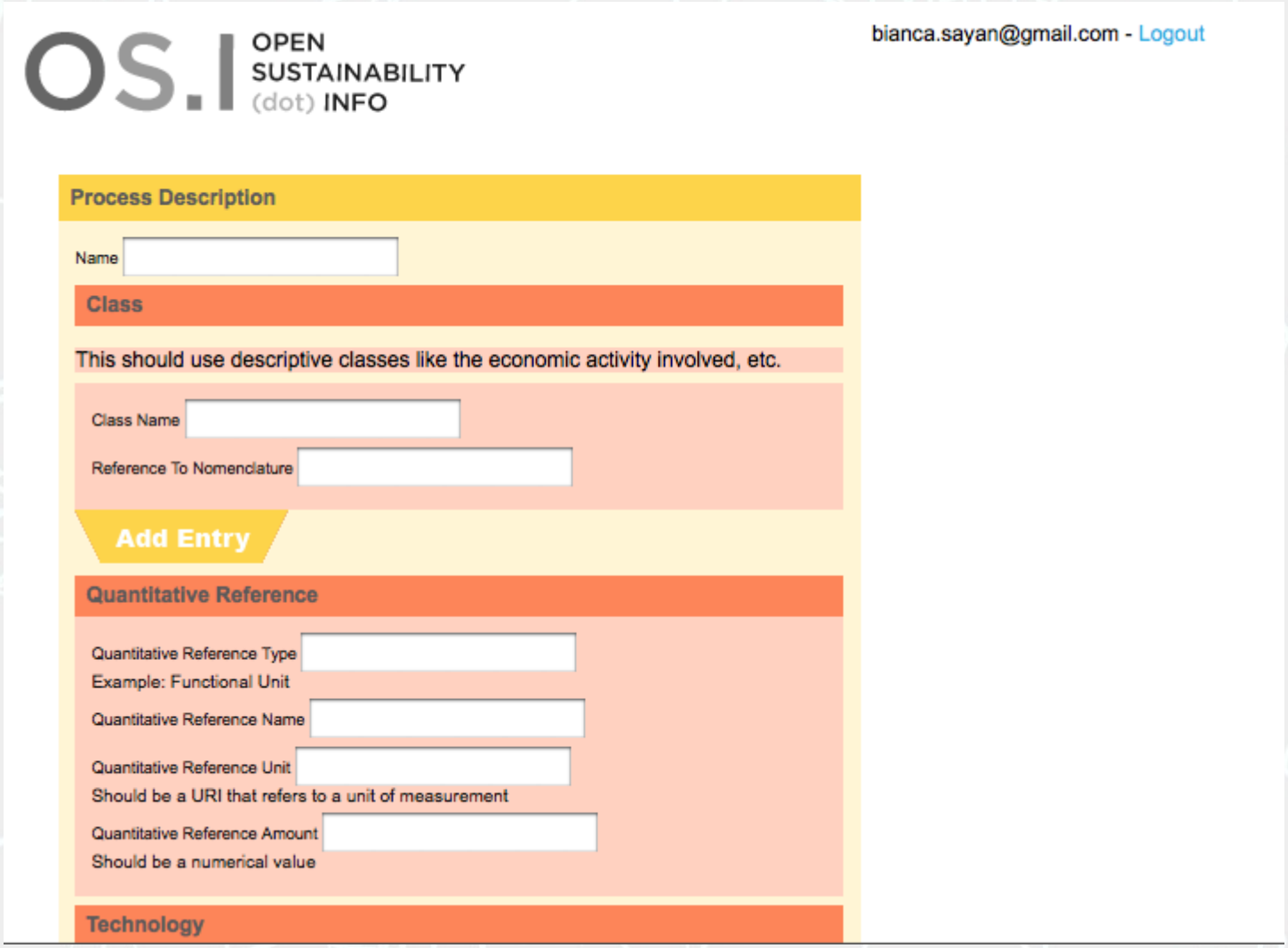
- unlimited number of data fields for the Sites (1.1.8.3);

- unlimited number of data fields for the Geographical Information System (GIS) reference (1.1.8.4, nomenclature 7.3);"

This translates to…

```
<owl:Class rdf:ID="valid_geography">
        <rdfs:label xml:lang="en-gb">valid_geography</rdfs:label>
        <rdfs:domain rdf:resource="#process_description">
      </owl:Class>
        <rdf:Property rdf:ID="area_name">
          <rdfs:label xml:lang="en-gb">area_name</rdfs:label>
          <rdfs:domain rdf:resource="#valid_geography">
          <rdfs:range rdf:resource="rdfs:Literal">
          <rdf:datatype rdf:resource="xsd:string">
        </rdf:Property>
        <rdf:Property rdf:ID="area_description">
          <rdfs:label xml:lang="en-gb">area_description</rdfs:label>
          <rdfs:domain rdf:resource="#valid_geography">
          <rdfs:range rdf:resource="rdfs:Literal">
          <rdf:datatype rdf:resource="xsd:string">
        </rdf:Property>
        <rdf:Property rdf:ID="sites">
          <rdfs:label xml:lang="en-gb">sites</rdfs:label>
          <rdfs:domain rdf:resource="#valid_geography">
          <rdfs:range rdf:resource="rdfs:Literal">
          <rdf:datatype rdf:resource="xsd:string">
        </rdf:Property>
        <rdf:Property rdf:ID="gis_reference">
          <rdfs:label xml:lang="en-gb">gis_reference</rdfs:label>
          <rdfs:domain rdf:resource="#valid_geography">
        </rdf:Property>
```

First Steps – Build a Database



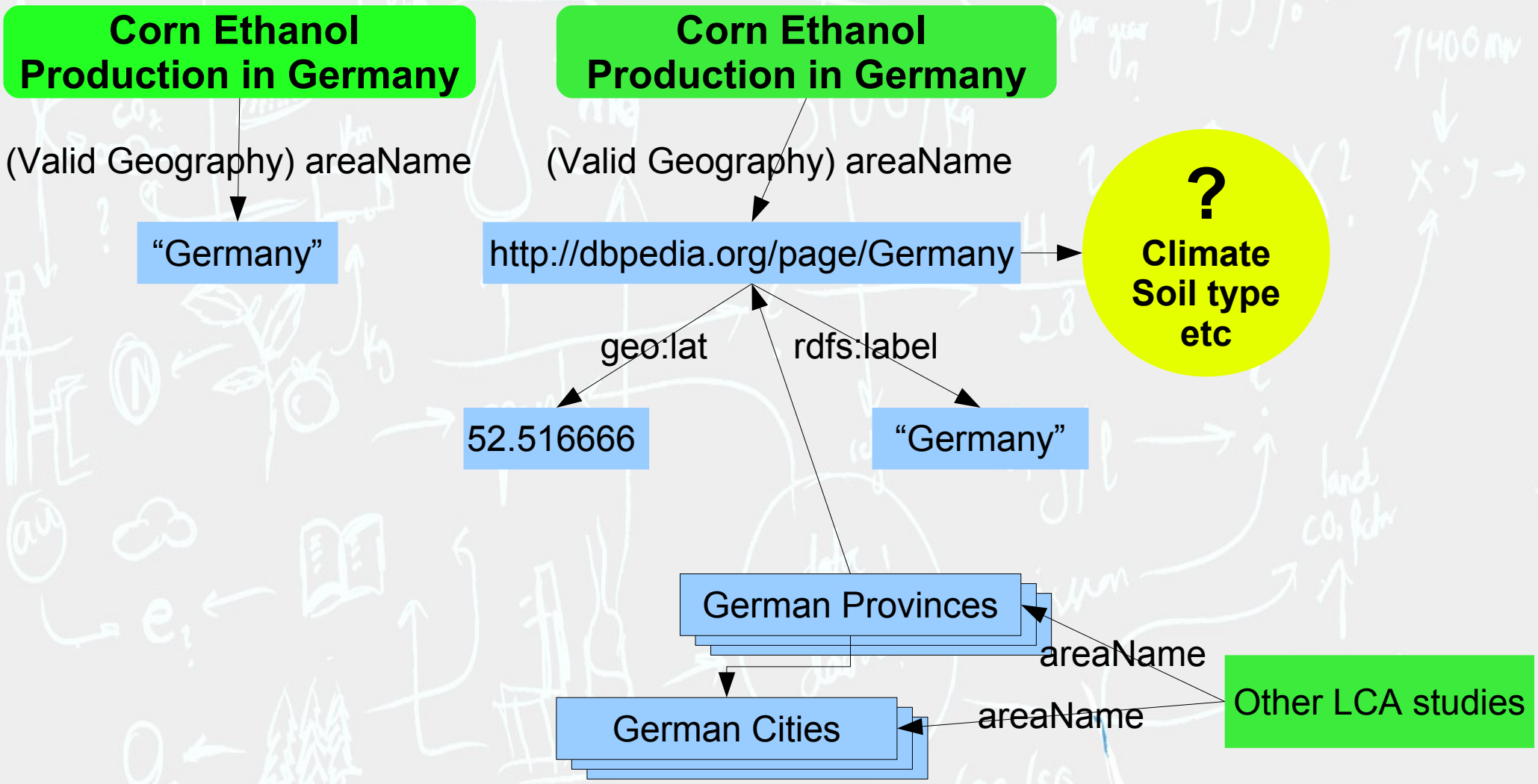
The data will look something like this:

_:YourValidGeography ISO14048:areaName 'Germany'
_:YourValidGeography ISO14048:areaDescription “Various sites around Germany”

Which is semantic, meaning others can find it easily and use it!

But it would be a lot better if it was linked, too…

When we link to other data instead...



First Steps – Search

Show 25 entries Search: m

Name	Object of Measurement	Greenhouse Gas Emissions	Energy Use	Water use
Milk	8 fluid ounce of Milk	247.6 g		
Spearmint	4 g of Spearmint	259.3 g		
Cucumbers	85 g of Cucumbers	45 g		
Palm oil	1 tablespoon of Palm oil	17.6 g		
Watermelons	280 g of Watermelons	66.5 g		
Lima beans (georgia)	35 g of Lima beans (georgia)	160.7 g		
Macadamia nuts	30 g of Macadamia nuts	221.4 g		
Lamb	114 g of Lamb	1407.4 g		
Peppermint	4 g of Peppermint	285.3 g		
Plums	140 g of Plums	72.7 g		
Almonds	30 g of Almonds	166.1 g		
Tomatoes	85 g of Tomatoes	87.8 g		
Blackstrap molasses (new orleans)	1 tablespoon of Blackstrap molasses (new orleans)	2 g		
primary aluminum ingot	primary aluminum ingotkg of 1000			
Surface mounting of printed board assembly (PBA)	1 pieces of Printed board assembly (PBA)			
primary aluminum ingot	1000 kg of primary aluminum ingot		140000 kg	10900 Liters

Showing 1 to 16 of 16 entries (filtered from 99 total entries)

Why OSI?

- LCA-specific issues: transparency, iterative improvement, feedback/review
- Tie together existing databases
- Anyone publishes an LCA → anyone can instantly access it
    - Same thing for new tools, models, ontologies, and visualizations
- Different data formats handled seamlessly and work together
- Easily build on existing body of work by using and modifying open source applications and open data. Reduced redundancy.
- Greater interaction and mutual benefits with LCA and non-LCA community (feedback, validation, e tc)

Challenges

- Building a sustained community of LCA experts
- Good open and linked supplementary data sets are still rare
- Must catch up to the available functionality of existing LCA software (capability)

Next Steps

- Building a community
- Adding data
- Make it publicly accessible
- Add other Ontologies : EcoSpold, etc
- Find or create open and linked supplemental data: NCAIS, chemical databases
- An “AppGarden”, showcasing published and available applications

More functionality: normalize and graph impacts, facilitate peer comments and validation

- Help participants submit data quickly by uploading it in existing formats

Title: Biofuels

Reference flow: kg of Ethanol

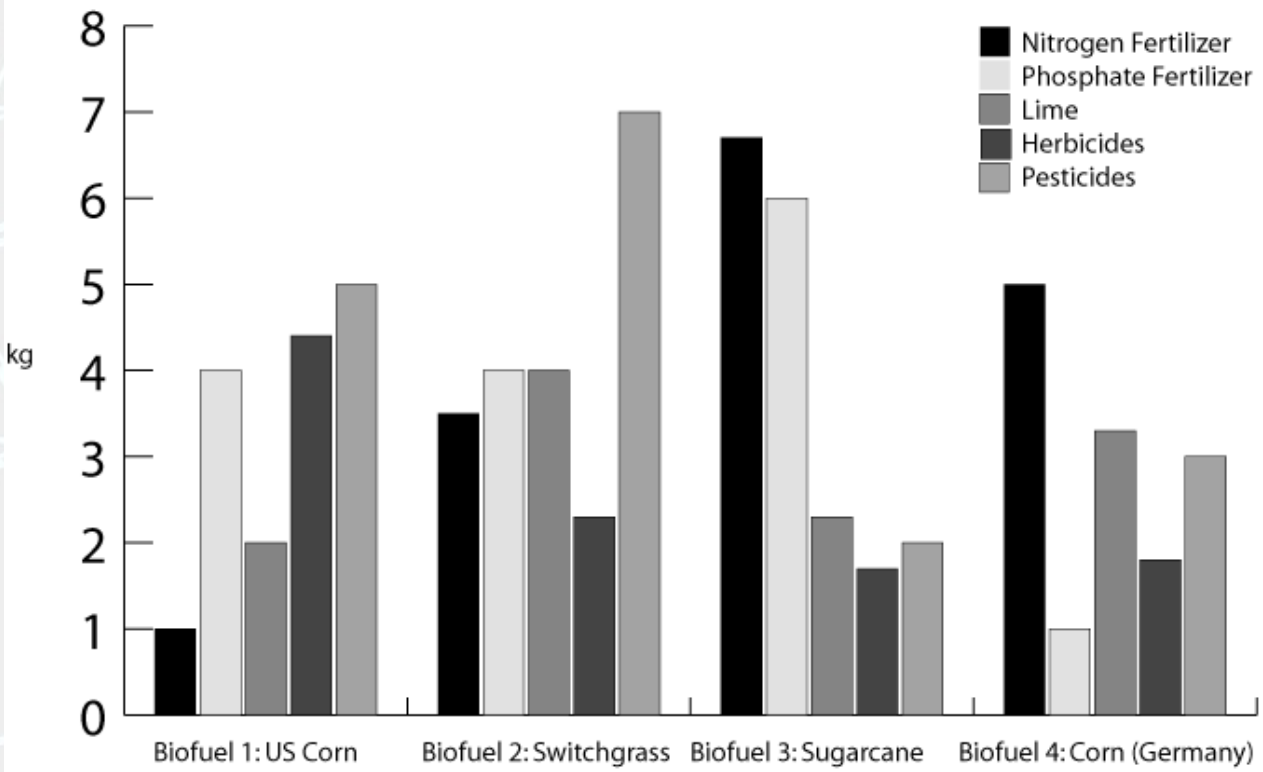
Graph Type: Inputs

Data

http://db.opensustainability.info/4055584322.rdf
http://db.opensustainability.info/4456578129.rdf
http://db.opensustainability.info/1018502335.rdf
http://db.opensustainability.info/1257994368.rdf

Add another dataset

- [x] Nitrogen Fertilizer (same as)
- [x] Phosphate Fertilizer (same as)
- [x] Lime (same as)
- [ ] Potassium Fertilizer (same as)
- [ ] Potash (same as)
- [x] Herbicides (same as)
- [x] Pesticides (same as)
- [ ] NPK Fertilizer (same as)



References

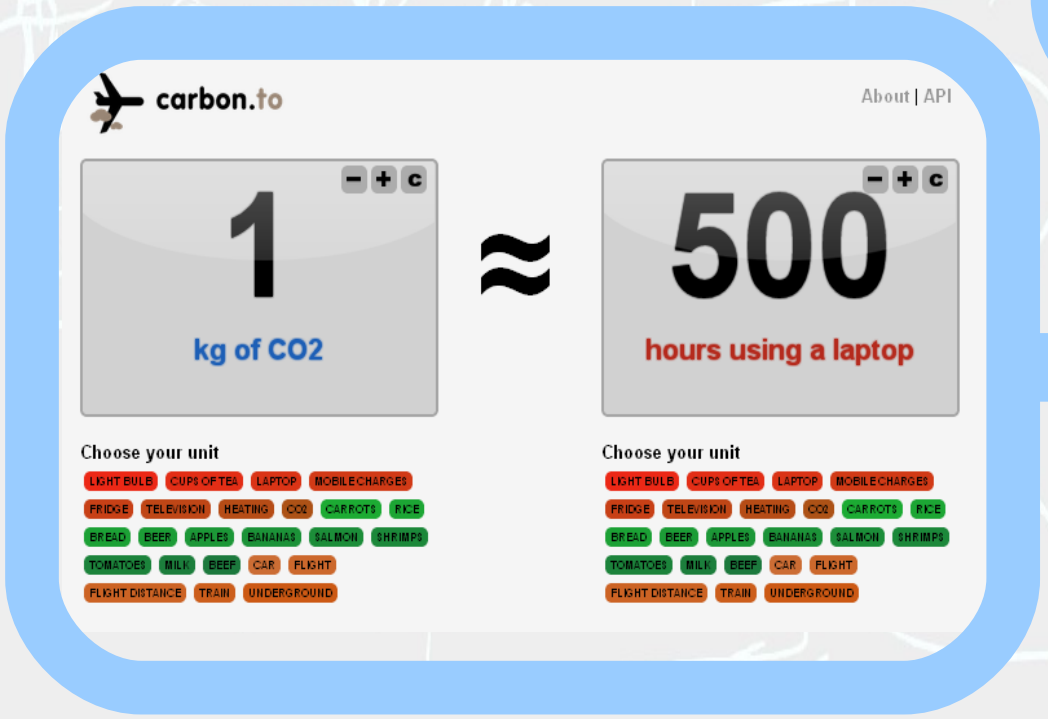
Fukushima, Y, and S P Chen. 2009. "A decision support tool for modifications in crop cultivation method based on life cycle assessment: a case study on greenhouse gas emission reduction in Taiwanese sugarcane cultivation." International Journal of Life Cycle Assessment 14:639-655.

Kim, S, and B Dale. 2005. "Environmental aspects of ethanol derived from no-tilled corn grain: nonrenewable energy consumption and greenhouse gas emissions." Biomass and Bioenergy 28:475-489. http://linkinghub.elsevier.com/retrieve/pii/S0961953404001916.

(Mock up)

Providing Valuable Data to Important Sustainability Applications

Sourcemap is an online application that helps businesses, researchers, and the public create their own supply chain maps to help them measure their own environmental impact.



Carbon.to helps people to understand the magnitude of GHG emissions by relating them to everyday activities and objects.

The most difficult aspect of open projects are not technical in nature. An open community is nothing without participants and their contributions. Here is how to contribute:

Share your Data
Go to **http://opensustainability.info** and start sharing

Or tell us why you will/won't
Help us understand your views on data sharing by participating in our survey starting November 15:

http://opensustainability.info/survey/

This data will also be used in the SETAC workshop on LCA database standardization in early 2011

Join Us.

info@opensustainability.info
http://opensustainability.info

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