

## Findhorn Ecovillage Carbon Footprint Assessment 2017



*The size of 1 tonne of carbon dioxide*

# Carbon Assessment 2017

## Introduction

An assessment of Findhorn Ecovillage's carbon emissions has been done for 2017 using the web-based calculation tool 'Our Impacts.' Ecometrica, the Edinburgh based software company, has kindly sponsored the use of 'Our Impacts.' The first assessment was done for 2015.

A large group of people participated in the data collection. Especially, I want to mention Roger Doudna, Amanda Haworth, Arun Patel, Gabrielle Buist, Kim Emerson, Jürgen Muthmann, and Sverre Koxvold.

*April 2017  
Göran Wiklund*

## Summary

The total emission of greenhouses gases has been calculated to **5,092 tCO<sub>2</sub>e**. The largest group of emissions is travel **4,367 tCO<sub>2</sub>e**. Out of this group flying is the dominating emission **3,460 tCO<sub>2</sub>e**. Car-driving accounts for **863 tCO<sub>2</sub>e**.

Total emissions for 2015 were **4,065 tCO<sub>2</sub>e**, which means there has been an increase of **1,027 tCO<sub>2</sub>e**.

Avoided or sequestered emissions amount to **3,594 tCO<sub>2</sub>e**. This is a gross figure and Trees for Life planting costs and cost of volunteers are not calculated and/or deducted.

It is difficult to make comparisons between the years as more emission sources have been added and data collection has improved. Also, 2015 was a pilot assessment and some data were not of high significance.

## Some comparative data to bear in mind

- *In order to halt global temperature increase each individual has a carbon budget of about 2.0 tCO<sub>2</sub>e*
- *The average UK emissions are 9.8 tCO<sub>2</sub>e/person, or 13.4 tCO<sub>2</sub>e/person (incl. all greenhouse gases)*
- *A return air trip economy class New York-Inverness emits 2.4 tCO<sub>2</sub>e.*
- *Emissions/person of CO<sub>2</sub>e using various transport means: Inverness-London return:*

<i>Bus</i>	<i>63 kg</i>	<i>Air</i>	<i>376kg</i>
<i>Train</i>	<i>107 kg</i>	<i>Car</i>	<i>413kg</i>

## Methodology

The focus has been on calculating the most substantial emissions.

The assessment is following the international standard Greenhouse Gas (GHG) Protocol. The Protocol requires measurement of 7 potent greenhouse gases. As the gases have different GWP, global warming potential, (methane for instance has 25 times higher GWP than CO<sub>2</sub>) all gases are converted to carbon dioxide equivalents, CO<sub>2</sub>e.

The GHG Protocol differentiates between three 'Scopes':

- Scope 1: direct emissions from burning fossil fuel (petrol, gas, wood etc.)
- Scope 2: indirect energy (purchased electricity)
- Scope 3: other indirect emissions (travel, food, consumption etc.)

Air travel has been calculated using an RFI factor 2.0 (Radiative Forcing Index). RFI factor means that air travel at high altitude causes larger emissions than the fossil content of the fuel. Factor 2.0 means a doubling of the fuel content emissions.

Upstream emissions have been added for the emissions where such data is available. That means emissions from, for instance, petrol, and gas, also emissions from production and distribution are calculated. For purchased electricity both upstream emissions and T&D losses (Transmission and Distribution losses) are included.

The emissions have been sourced from four organisational units:

- The Park
- Cluny
- Titleholders Association/Park residents
- Businesses

Newbold, Cullerne, Iona and Erraid are not included.

In some cases, data collection is based on estimates. That is the case for calculation of travel by THA/residents, co-workers and businesses, where a survey was carried out.

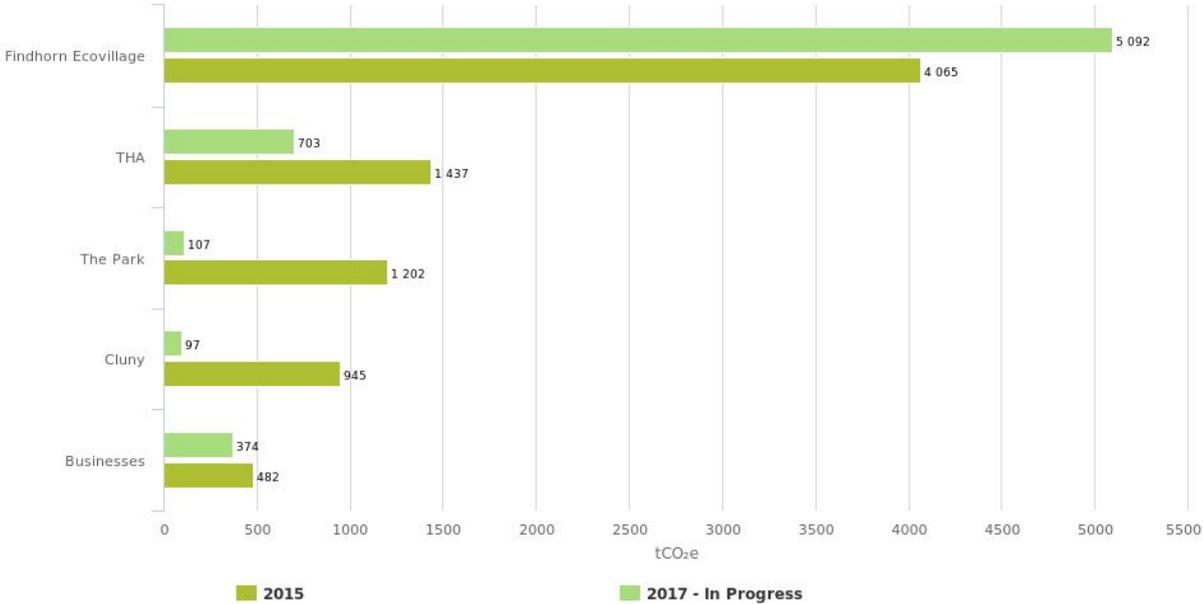
NFA full members were asked to participate and a questionnaire was distributed. The response rate, however, was too low to be used for statistical approximations, which means that for this year NFA full members were excluded.

Energy emissions are shown on an aggregated Findhorn Ecovillage level and are not calculated by each organisational unit. The reason is that NFD, who provided much of the data, was not able to divide up the consumption figures without charging for their work.

# Results

## Total emissions

The total measured emissions are 5,092 tCO<sub>2</sub>e. That is an increase with 15% compared with 2015 when the total was 4,065 tCO<sub>2</sub>e.

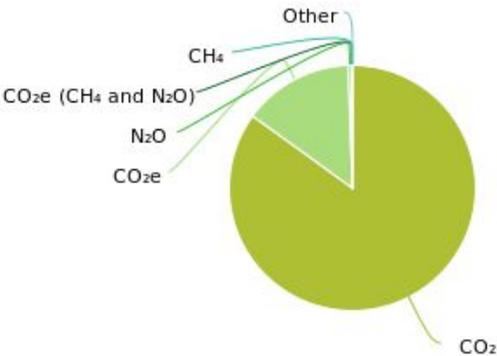


**Table 1. Total emissions**

Unfortunately, a direct comparison can't be made between the two years as energy consumption is not divided per organisational unit but only shown on an aggregate Findhorn Ecovillage level. In addition, more emission sources are included, and a more comprehensive data collection has resulted in an increase in emissions.

## Greenhouse gases

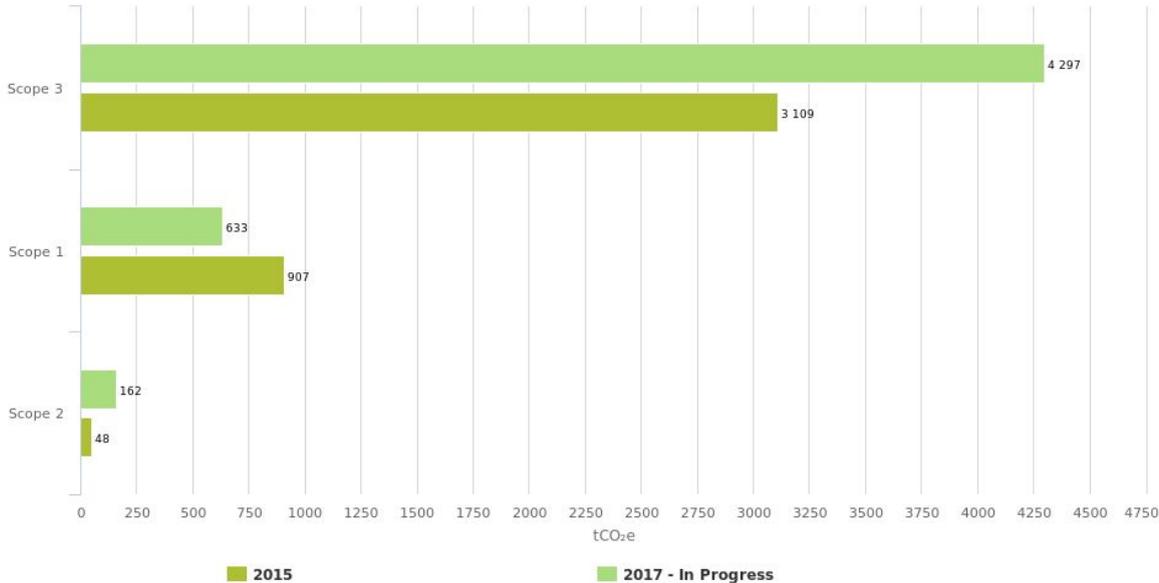
There are 7 greenhouse gases with various global warming potential.



**Table 1. The greenhouse gases**

As can be seen in the diagram most of the emissions comes from CO<sub>2</sub>, carbon dioxide. CO<sub>2</sub>e emission represents emissions where the various gases have not been specified.

### Emissions divided by scope

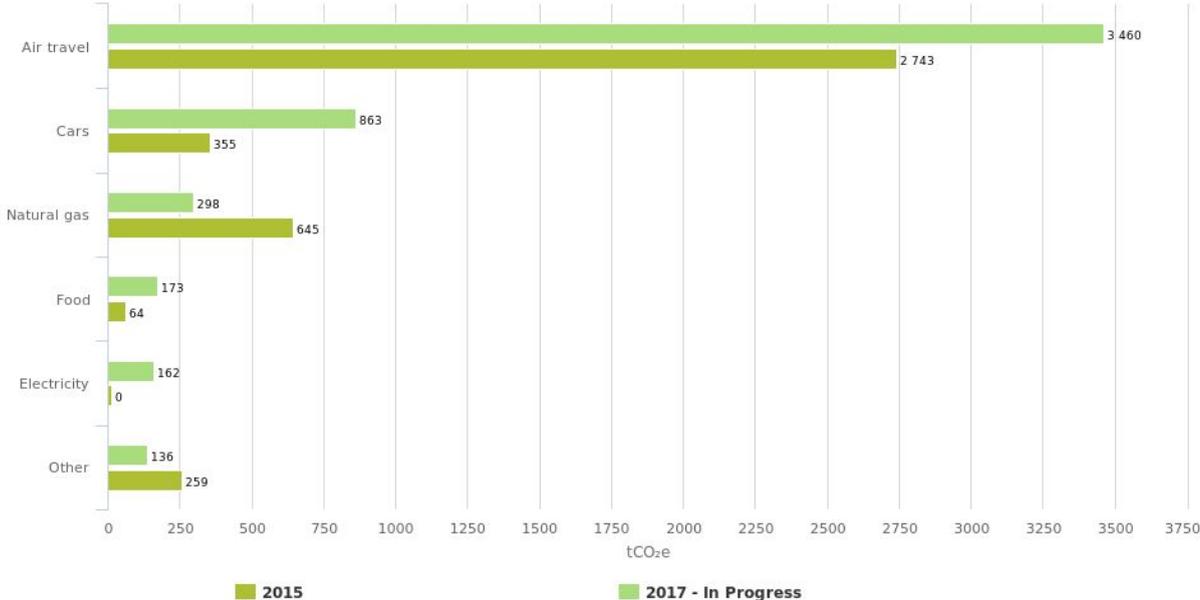


**Table 2. Emissions divided by scope**

Scope 3, indirect emissions, is the largest, **4,297 tCO<sub>2</sub>e**, or 86%.  
 Scope 1 emissions (emissions directly from burning fossil fuel and generation of wind energy) are **633 tCO<sub>2</sub>e**.  
 Scope 2, purchased energy is the smallest, only **162 tCO<sub>2</sub>e**.  
 ★ Scope 2 (indirect emissions from purchased electricity) is 67 tCO<sub>2</sub>e. The reason for the low Scope 2 emissions is that most energy comes from the Findhorn Wind Park, with very low emissions, and a lesser amount from the grid.

### Emissions divided by emission source

Most of the emissions come from air travel by co-workers/residents and guests, **3,460 tCO<sub>2</sub>e**.



**Table 3. Emissions divided by emission source. The diagram shows the largest emissions.**

One reason for the increase in travelling is the fact that this year we collected data from co-workers' air travel, which was not included 2015.

Since air travel is the largest emission source a closer analysis has been done.

	Short haul, number	Medium haul, number	Long haul, number	Total emission, tCO <sub>2</sub>
Co-workers	259	144	62	158
THA/Residents	555	124	171	300
Findhorn businesses	6		2	4
Guests	2,417	1,063	795	2,940
Holiday park guests		141		58

**Table 4. Air travel divided by distance**

Air travel is divided into three distance categories. Emission per passenger-kilometre differs in each category. One reason is that flying at high altitudes results in more emissions caused by the white trails. Another is that take-offs cause relatively more emissions per distance than cruising. This is why flying is divided into short trips, up to 785 km (within UK) or less than 2 hours in air; medium trips, from 785 km to 3700 km or 2-4 hours (within Europe); and long trips over 4 hours (outside Europe).

It is assumed that all flying is done in economy class, which results in less emission per passenger-km than business or first class do (as it occupies less space).

The total number of guests was 2,976 coming from 50 countries, of which 36% were travelling from Great Britain, 13% from USA and 9% from Germany. The number of guests in 2015 was 1,753 coming from 61 countries.

Emissions from guests were **2,940 tCO<sub>2</sub>e**. Emissions from residents, co-workers, business staff were **462 tCO<sub>2</sub>e**. Holiday Park guests added **58 tCO<sub>2</sub>e** from air travel, a relatively low number as it is assumed that the largest number of guests travelled by other means, mainly car.

## Energy

Emission from different energy sources amounts to **499 tCO<sub>2</sub>e**.

Gas	298 tCO <sub>2</sub> e
Electricity grid	162
Electricity wind	14
Fuel oil	1
Wood/pellets	24

Cluny is connected to the grid and 25% of the electricity consumed in the Park is from the grid. Grid electricity without a certificate of origin showing it is renewable has a relatively high emissions factor, whereas wind-power has a low emission factor.

The Findhorn Wind Park produces energy for local use at the Park and exports its overflow to the grid. There is also a certain import from the grid. The reason for the relatively high grid import is due to the fact that wind-power production was down during two months of 2017.

Gas is the second largest emission source after travels. Gas is used at Cluny and in most households in the Park for heating and cooking.

The Park wood chip boiler provides heating for the Universal Hall, Park Building, Community Centre and 7 other bungalows. Soillse has its own wood pellet boiler. Many households rely on burning wood in stoves. There is a local production of fuel wood. Kajedo Wanderer provides about 27 tonnes of firewood for Foundation users.

### **Intensity emissions**

The overall emission per person within the community, i.e. co-workers, residents, business staff (383 individuals) , is **13,3 tCO<sub>2</sub>e**. This is a higher number than 2015, **9,5 tCO<sub>2</sub>e**. The reason is that for 2017 more emissions were measured and there was more accurate data.

If emission from guests' flying is deducted from the calculations the emission per person is **5,3 tCO<sub>2</sub>e**.

Emission per guest (guests participating in courses, education etc) is **1,7 tCO<sub>2</sub>e**.

### **Food**

Emission from food, **173 tCO<sub>2</sub>e**, is based on two meals per day being served to guests and co-workers in the Community Centre and at Cluny. Most THA residents do their own cooking but there is no data on that.

Calculations are based on the assumption that vegetarian food is served. There is a certain over-estimation of emissions as local food from Cullerne Garden is used when available with less transport emissions than average food.

### **Data quality**

Where data was missing approximations have been made. When collecting data from THA/residents a survey was carried out and residents were asked about travel patterns, and such energy purchase that was not via NFD. The response rate was 63%. In order to get 100% it was assumed that the travel pattern and energy purchase was similar for the remaining 37%.

Likewise, a survey among co-workers was done with questions about travel patterns with a response rate of 24%. This is a very low response rate, which makes the result, when adding the remaining 76%, uncertain.

Information has been collected from businesses that have their office/operation at the Park. However, responses have not been collected from all of them.

Data on use of paper and printed material has not been available.

## Sequestered carbon and avoided emissions

Trees sequester carbon when they grow. Trees for Life plants trees as its business. Totally, an area of 897 ha has been planted over 27 years. The sequestration calculation is based on a model developed by Woodland Trust. The sequestration for 2017 is estimated to be **3,400 tCO<sub>2</sub>e**. However, emissions for managing the tree planting in terms of travel and lodging of volunteers should be deducted from that figure, but the emissions are not calculated.

Avoided emissions are a result of burning wood or pellets instead of heating with gas or electricity.

Pellets contain 4,67 kWh/kg. In the Park wood chip boiler and in Soillse’s pellet burner 483 MWh was produced. The emissions were 24 tCO<sub>2</sub>e. If this energy had instead come from gas, the emissions would have been 69 tCO<sub>2</sub>e. Thus an amount of **45 tCO<sub>2</sub>e** was avoided.

Avoided emissions also result when delivering wind power that replaces grid electricity. During 2017 a total of **375 MWh of wind power** was ‘exported’ to the grid. The emission from this export was 6 tCO<sub>2</sub>e. Had the corresponding amount of kWh been produced with the average UK emissions factor, the emission would have been 144 tCO<sub>2</sub>e. The avoided emissions were thus: **138 tCO<sub>2</sub>e**.

The total sequestered and avoided emission amount to **3,594 tCO<sub>2</sub>e**.

Emissions are also avoided by cutting and burning wood from Findhorn’s woodland. The emissions effect has not been calculated.

## Reducing emissions

There are many ways to reduce emissions, both indirect and direct. Indirect is for instance, the Carbon Conversations workshops that have taken place. They aim at raising carbon consciousness and also spreading knowledge on how to reduce one’s emissions. Direct steps could be either on Ecovillage level or where individuals decide to reduce their carbon footprints.

### Strategies to reduce emissions

Green electricity to the Park	The import from the grid should be certified as renewable electricity
Green electricity at Cluny	The import from the grid should be certified as renewable electricity
Purchase of green gas	Gas for both the Park and Cluny should be certified as renewable
Education, training	Carbon consciousness as an aspect of global awareness, being one with nature and to live lightly on the planet should be part of all curricula
Guest and resident/co-worker travel	Encourage travelling by bus or rail at least as part of journeys. Avoid flying. Avoid using car

Resource sharing	Having access to resources rather than owning. Car sharing. Taking advantage of the nearby car sharing pool.
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## Continuous reporting and data improvement

Reporting carbon emission is to a large extent about creating carbon consciousness, the carbon effects of one's life.

Carbon calculation, assessment and reporting should take place annually in order to be aware of both the global and the local need to reduce emissions in order to keep the global temperature on a level well below 2°C .

### Possible improvements

Resident travel and energy reporting	A higher response rate
Co-worker travel reporting	A higher response rate
Differentiate energy consumption of FF, THA and businesses (including NFD)	NFD's bookkeeping needs to keep track of the bills so that at the end of the year it is easy to add up each of the three units.
Travel information from guests	Travel means should be part of registration
The use of cars	The spreadsheet should emphasise that car size and fuel are important data
Paper and printed material	Identify units within the Ecovillage that purchase paper and printed material, and have the weight of such purchases registered
Trees for Life volunteers	TFL uses volunteers for tree planting. Data on their travel to and from Findhorn should be added
Include full NFA members	Emphasising the importance that the whole community is engaged in the data collection so we know where we stand re. emissions

This year there is an improvement in data collection compared with 2015. Resident travel and energy purchase with suppliers other than NFD is not based on an assumption this year, but on a survey where residents have reported their household data. In the same way, co-workers and business have filled in a survey to report their travelling.

**The largest emission is guest travel.** To calculate emissions a model is used based on the country of the participant and an estimation of the travel distance from each country. In this model, guests from UK are either flying a distance equivalent to London-Inverness, driving from Manchester, or taking the train from Edinburgh. For guests coming from outside UK it is assumed that they fly to Inverness via London.

It would be helpful if guests were asked when registering how they are travelling to Findhorn: from where and by what means.

The information in the surveys should emphasise the importance of reporting what size car and what fuel one has been using as this affects the emissions.

Energy consumption this year could not be divided up on the different organisational units. All Park consumption is only reported as total consumption. NFD will for 2018 divide up the billing system so that total consumption for FF, THA and businesses can be separated.

Paper and printed material is not a large emission but since it uses trees, which are a diminishing resource, it should be measured. When purchasing paper and printed material suppliers should be asked to declare the physical weight of the paper, and it should be registered by the department that purchases.

Trees for Life uses volunteers during the tree-planting season. A data improvement would include information about where their volunteers travel from.

## **Carbon offsetting**

The fact that Findhorn Ecovillage is an international community means that there is a lot of travelling. Guests are coming from many parts of the world and many living in the Ecovillage have families in other countries. Flying therefore becomes a large source of emissions. The first question then becomes whether flying can be avoided. Another question, which many today are considering is if holiday trips can take place nearer home.

Very often, flying could be replaced by surface transport by rail or bus, at least as part of a longer trip. From this perspective, flying from Edinburgh or Aberdeen can often result in lower emissions than flying from Inverness.

**When carbon emissions are unavoidable, offsetting is the only way to take responsibility for one's emissions.**

Since December 2017 guests have been asked to offset their emissions when they register to come to Findhorn. Residents/co-workers/employees are also encouraged to offset emissions that can't be avoided. **It should be emphasised that the real cost of flying is the price of the ticket plus the price of offsetting.** And that *not offsetting* lets future generations carry the responsibility of non-action today. Not taking responsibility for one's emissions is called *externalising one's environmental impact*. It means that polluting the atmosphere is done without paying a price.

## Definitions

**Carbon footprint:** A measure of how much CO<sub>2</sub> emissions are associated with fossil energy use. When studying ecological footprints the carbon footprint is added because it is a competing use of bio-productive space, since increasing CO<sub>2</sub> concentration in the atmosphere is considered to represent a build-up of ecological debt, and is believed by the scientific community to be a primary driver of global warming.

**Ecological footprint:** A measure of how much area of biologically productive land and water an individual, population or activity requires to produce all the resources it consumes and to absorb the waste it generates, using prevailing technology and resource management practices. The Ecological Footprint is usually measured in global hectares (gha). Because trade is global, an individual or country's Footprint includes land or sea from all over the world. Without further specification, Ecological Footprint generally refers to the Ecological Footprint of consumption.