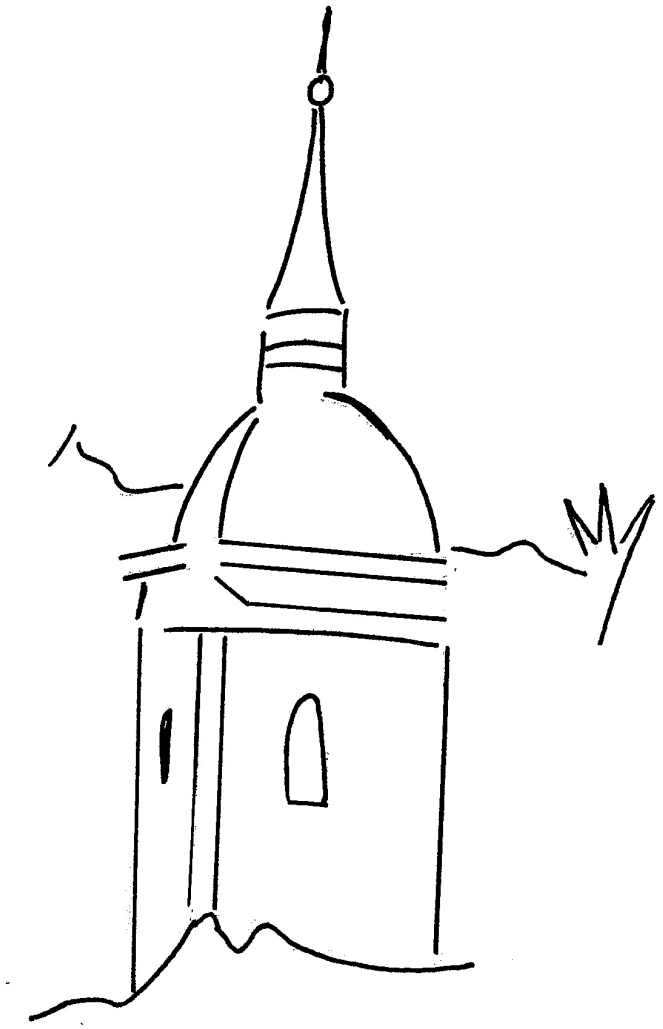
CARBON FOOTPRINT CALCULATION



IROTA ECOLODGE

2016

1. Introduction

Irota EcoLodge is a small-scale sustainable holiday resort in Northern Hungary, consisting of three holiday homes and a biological swimming pool. Construction took place from mid 2015 until spring 2016 and the resort was opened on the 7th of July 2016. Irota EcoLodge can claim to be the first, and so far only[1], climate-neutral holiday accommodation in Hungary. Among the sustainability features, climate-neutrality is one[2].

Carbon neutrality, or having a net zero carbon footprint, refers to achieving net zero carbon emissions by balancing a measured amount of carbon released with an equivalent amount sequestered or offset, or buying enough carbon credits to make up the difference[3].

To sustain this climate-neutrality claim, Irota EcoLodge will annually publish a carbon footprint calculation. This report is contains the first calculation covering the year 2016.

Picture 1: 6.56 kWp photovoltaic solar system (right) and solar collectors (left) at the Middle House.

1 According to the Hungarian Hotel & Restaurant Association.
2 For a full overview see: http://irotaecolodge.com/en/econess.html.
3 https://en.wikipedia.org/wiki/Carbon_neutrality, accessed on 23 May 2017.

2. Carbon emissions sources

Irota EcoLodge consists of three physical locations: First Irota EcoLodge itself with the three holiday homes (Lower, Middle and Upper House) and a swimming pool. The second location is the utility building in Irota where bed linen is washed and stored. On the same plot a small house is located with a kitchen, living room and bathroom. The third location is the Budapest City Apartment: this apartment is offered in a package deal to guests of Irota EcoLodge, but also rented out separately through AirBNB. A fourth 'location' are fuels for the company car and garden maintenance equipment.

The following 12 sources of carbon emissions where identified at these four locations:

Irota EcoLodge:

1. Emissions as a result of electricity being consumed in the houses, mainly to produce hot water in case the solar collectors cannot produce sufficient heat during winter.
2. Offset emissions as a result of electricity being generated by the solar panels on the roof of the Middle House. As solar panels generate emission-free electricity, feeding this electricity into the holiday homes or into the grid results in less emission by power plants connected to the electricity grid.
3. Each house has a cooking stove using propane/butane gas supplied in gas cylinders. These on-site emissions occur by burning of this gas in the stove.

Utility building and the Litte House:

4. Emissions as a result of electricity being consumed, mainly by the washing machine.
5. Offset emissions as a result of electricity being generated by the solar panels on the roof of the utility building. As solar panels generate emission-free electricity, feeding this electricity to the utility building and into the grid result in less emission by power plants connected to the electricity grid.
6. The small house has a cooking stove using propane/butane gas supplied in gas cylinders. These on-site emissions occur by burning of this gas in the stove.

Budapest City Apartment:

7. Emissions as a result of electricity being consumed. These emissions occur not on-site, but off-site at power plants feeding into the electricity grid.
8. The house in which the apartment is located, has a central heating system fuelled by natural gas. Individual meters are installed in each apartment, so that the total gas consumption for heat generation can be attributed to each apartment.

9. The house in which the apartment is located, has a central cooling system powered by electricity. Individual meters are installed in each apartment so that the total electricity consumption for cooling can be attributed to each apartment.
10. Hot water is also centrally generated using natural gas. Individual meters are installed in each apartment, so that the total gas consumption for hot water product can be attributed to each apartment.

Fuels:

11. The company car uses diesel fuel. It is used both for business and private use and often trips are combined. Therefore it is not possible to determine precisely which part of the emissions should be assigned to business use. Half would be an estimated guess, but to be on the conservative side 75% of the emissions have been assigned to business purpose.
12. Gasoline to fuel garden tools is used to maintain the garden at Irota EcoLodge and around the utility building. Also, chain saws are used to cut firewood. The garden tools are used both for business and private use. Approximately 25% are company related, but to be on the conservative side all of the emissions have been assigned to business purpose.

The following emission sources have not been taken into account:

13. The heating of the houses occurs with firewood. The firewood is sourced locally from the surrounding forests. As these forests are replanted, the occurring carbon dioxide emission will be absorbed when new tree grow (short-cycle carbon emissions). In accordance with carbon accounting practise, these emission can be set at zero.
14. Another source of carbon emission is the usage of charcoal or firewood in the outdoor kitchens. Similarly, these are short-cycle carbon emissions and can be set zero.

3. Calculations

To calculate carbon emissions, the following Carbon Emission Factors (CEF) have been used:

Electricity[4]	0.566	$kgCO_2/kWh$
Butane/propane	2.95	$kgCO_2/kg$
Natural gas	56.1	$kgCO_2/GJ$
Diesel	2.7	$kgCO_2/litre$
Gasoline	3.2	$kgCO_2/litre$

Table 1: Carbon Emission Factors

Location and source	**quantity unit**	**CEF**	**$kgCO_2$**
Irota EcoLodge			
1 Generated electricity	6,986 kWh	-0.566	-3,954
2 Consumed electricity	3,726 kWh	0.566	2,109
3 Cooking	9.1 kg	2.95	27
Utility building			
4 Generated electricity	5,304 kWh	-0.566	-3,002
5 Consumed electricity	1,682 kWh	0.566	952
6 Cooking	6.8 kg	2.95	20
Budapest City Apartment			
7 Electricity consumption of appliances	1,147 kWh	0.566	649
8 Gas consumption for heating	4.8 GJ	56.1	269
9 Electricity consumption for cooling	372 kWh	0.566	211
10 Gas consumption for hot water	5.2 GJ	56.1	292
Fuels			
11 Diesel fuel for company car	815 litre	2.7	2,217
12 Gasoline fuel for garden tools	49 litre	3.2	157
Total			**-53**

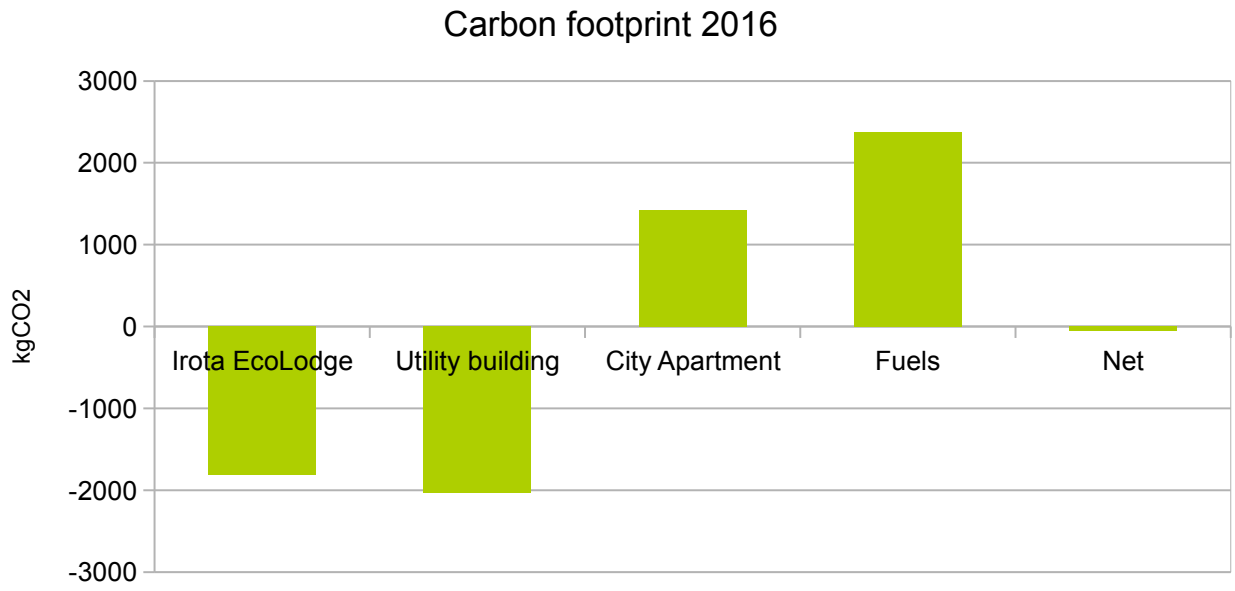
Table 2: Calculation of carbon emissions

4 http://www.eumayors.eu/IMG/pdf/technical_annex_en.pdf. Convenant of Mayors, technical annex containing emission factors.

4. Conclusions

The net carbon emissions in the first year of operation is -53 $kgCO_2$. This proofs that Irota EcoLodge is indeed a climate-neutral resort and even slightly reduces emissions.

The main emission source at Irota EcoLodge is the company car, which is offset by the surplus of electricity generated by the solar panels (see graph). This is a rather inefficient way to obtain climate neutrality. The plan, however, is to use the surplus solar electricity to fuel an electric powered car in the near future.



Graph 1: Overview of emissions per location.

Irota, 26 May 2017

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