Project Life SUSTAINHUTS

Sustainable mountain huts in Europe: Toward zero emissions

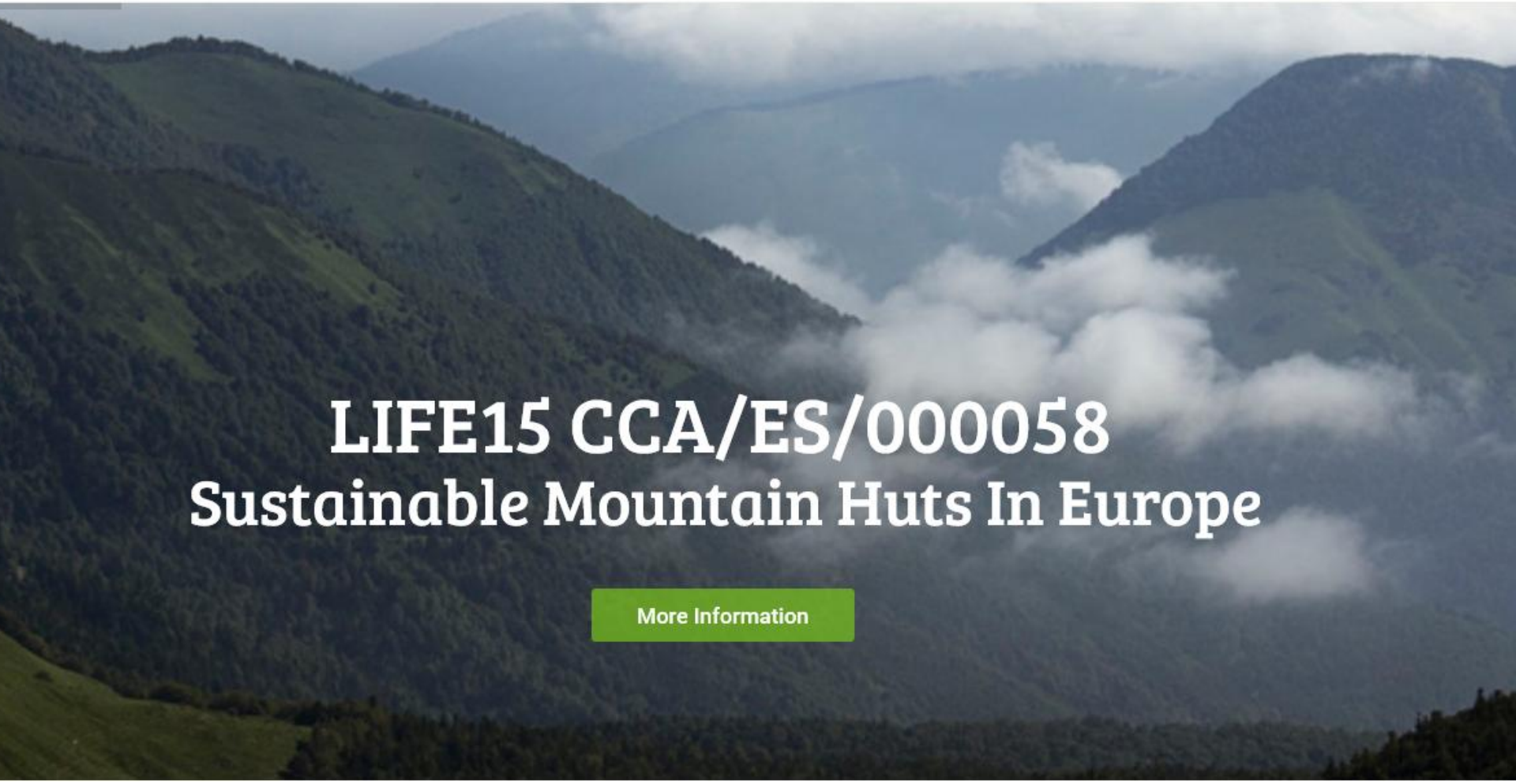
Mitja Mori, Rok Stropnik, Boštjan Drobnič , Mihael Sekavčnik

University *of Ljubljana*

LIFE15 CCA/ES/000058

Introduction

- Goals of the Life SustainHuts project
- Selected mountain huts
- Mass and energy balance of mountain huts
- Environmental impact assessment
- Towards sustainable operation of mountain huts
- Conclusions: zero emissions?


Home
Project
Locations
Partners
News
Downloads
Life
Contact
English
LIFE15 CCA/ES/000058
Sustainable Mountain Huts In Europe
More Information

↓8 t/a CO_2 **↓0,5 t/a NO_x** **↓20% Energy**

Execution of demo-sites 04

Implementation Actions

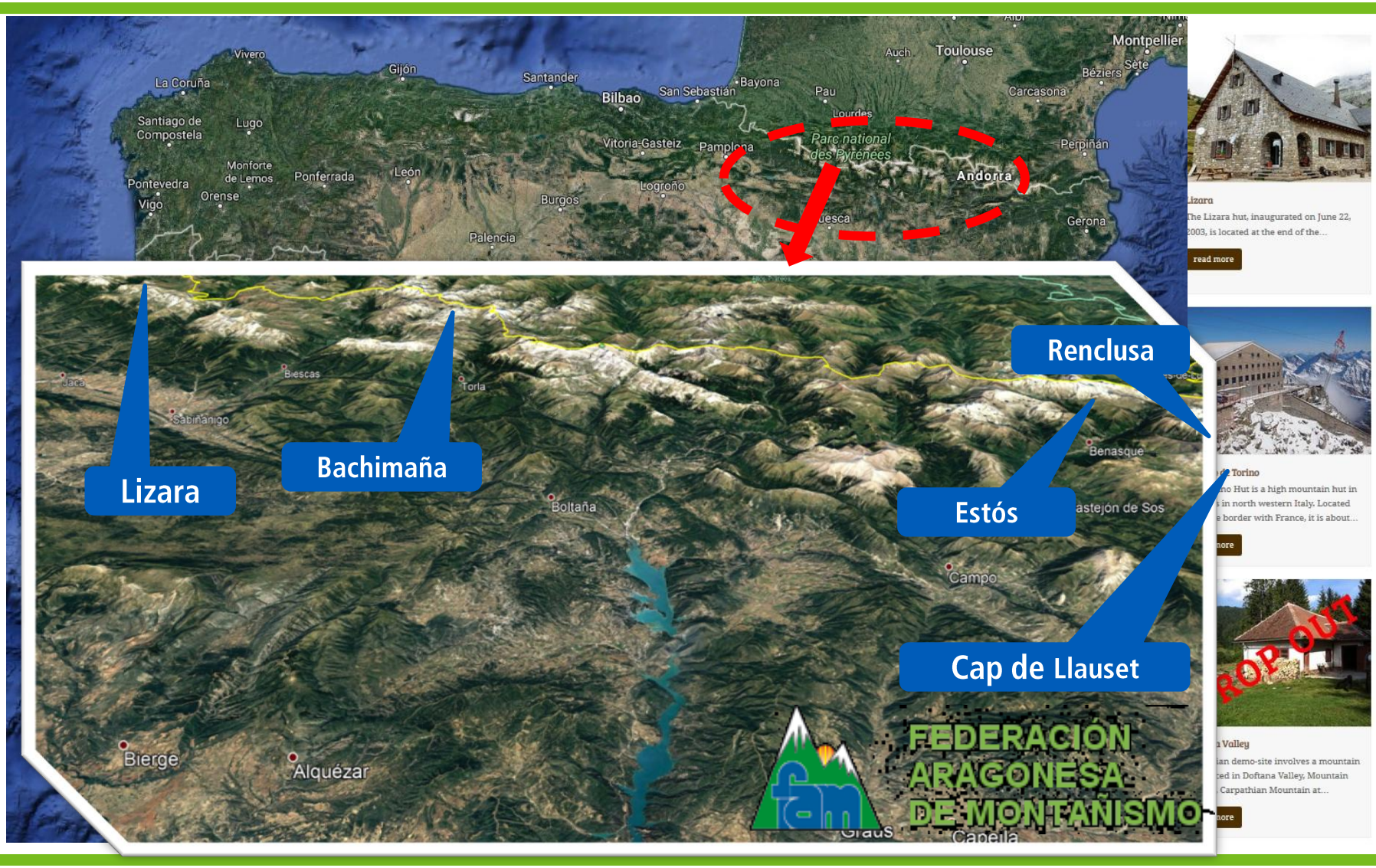
Guidelines and methodologies

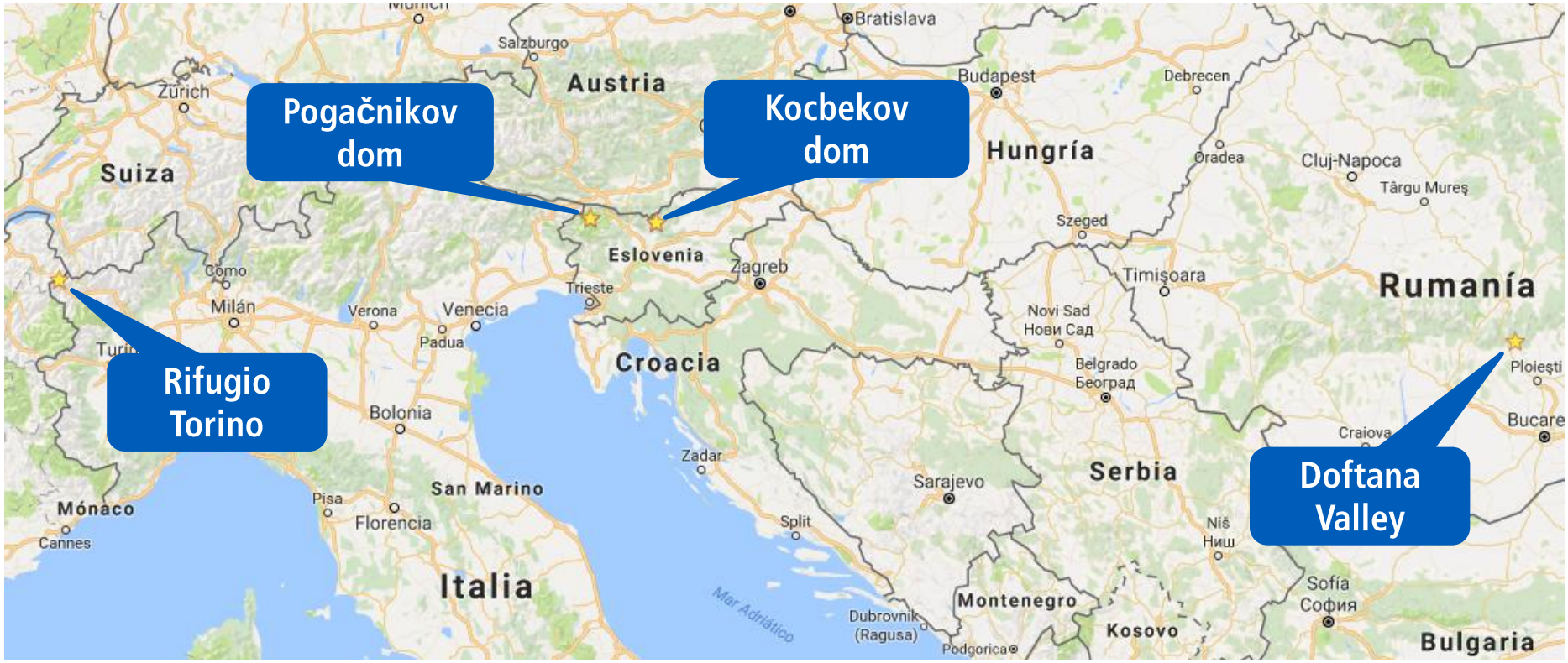
07

↓20% Fuel

Mountain huts

Location, altitude


Vivero
Gijón
Santander
Bilbao
San Sebastián
Bayona
Auch
Toulouse
Montpellier
Béziers
Sète
Carcasona
Pau
Lourdes
La Coruña
Santiago de Compostela
Lugo
Vitoria-Gasteiz
Pamplona
Parc national des Pyrénées
Perpiñán
Andorra
Monforte de Lemos
Ponferrada
León
Pontevedra
Vigo
Orense
Logroño
Burgos
Gerona
Palencia
Jaca
Biescas
Torla
Sabiñánigo
Benasque
Lizara
Bachimaña
Renclusa
Estós
Boltaña
Campo
Cap de Llauset
Bierge
Alquézar
Graus
Capella
FEDERACIÓN ARAGONESA DE MONTAÑISMO
read more
ROP OUT


Pogačnikov dom
Kocbekov dom
Rifugio Torino
Doftana Valley
Austria
Hungría
Rumanía
Eslovenia
Croacia
Serbia
Italia
Suiza
Mónaco
Montenegro
Kosovo
Bulgaria
Bratislava
Budapest
Debrecen
Zurich
Salzburgo
Cluj-Napoca
Târgu Mureș
Szeged
Timișoara
Zagreb
Trieste
Como
Milán
Verona
Venecia
Padua
Novi Sad
Нови Сад
Belgrado
Београд
Ploiești
Bucare
Craiova
Bolonia
Zadar
Sarajevo
San Marino
Pisa
Florencia
Split
Niš
Ниш
Cannes
Sofía
София
Dubrovnik
(Ragusa)
Podgorica
Mar Adriático
Oradea

Mass and Energy balance

Electricity, Heat in transport

Electricity generation

Hut	location	altitude, m	PV	Electricity grid	Fossil fuels	Batteries	micro Hydropower
Bachimania	Pyrenees, Spain	2200	✓	×	✓	✓	✓
Lizara		1540	✓	×	✓	✓	×
Llauset		2425	✓	×	✓	✓	×
Estos		1890	✓	×	✓	✓	✓
Refugio Torino	Alps, Italy	3350	×	✓	×	×	×
Pogacnikov Dom	Alps, Slovenia	2050	✓	×	✓	✓	×
Kocbekov dom		1808	✓	×	✓	✓	×

- **(Too)big share of fossil fuels!**
- Electricity grid: Refugio Torino
- Hugh possibility of photovoltaics
- 2 case studies micro hydropower
- (Still) without hydrogen technologies

Heat
(domestic hot water and heating)

Hut	Location	Altitude, m	Stove	Other
Bachimania	Pyrenees, Spain	2200	✓ (disel)	✓(electric heater)
Lizara		1540	✓ (firewood, NG)	✓(solar thermal collectors for hot water)
Llauset		2425	✓ (Firewood, pellets)	×
Estos		1890	×	✓ (diesel water heater)
Refugio Torino	Alps, Italy	3350	✓ (pellets)	✓ (electric water heater, gasoline water heater)
Pogačnikov Dom	Alps, Slovenia	2050	✓ (Firewood)	✓ (stove)
Kocbekov dom		1808	✓ (Firewood)	✓ (stove)

- Main fuel for heating: **firewood and pellets**
- **Fossil fuels and and electricity for heating**
- Solar thermal collectors just in one case!

Transportation and supplying

- Staff
- Food
- Water
- Energy sources
- Waste
- Other (maintenance, material…)

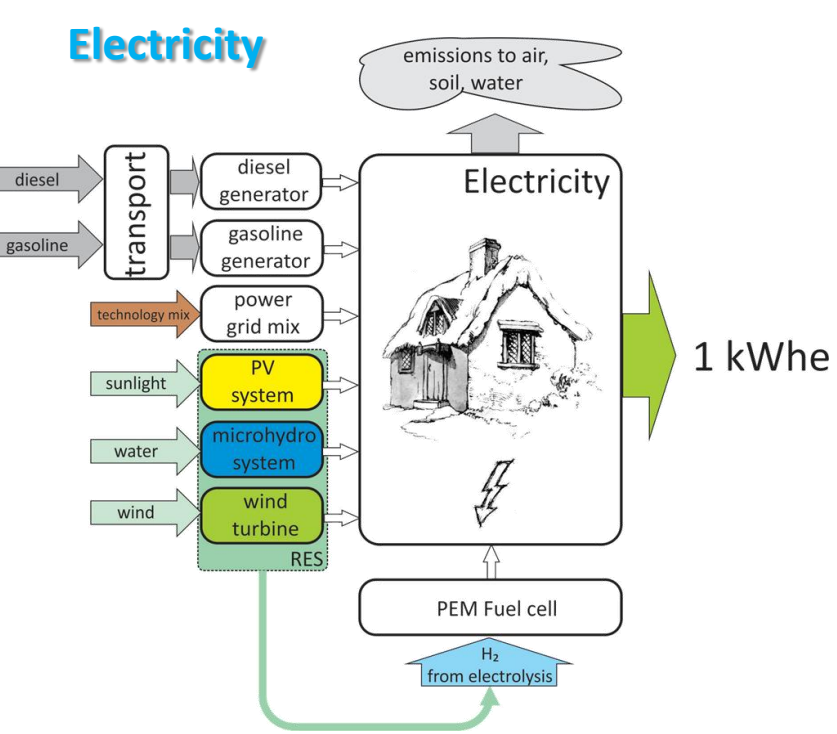
100 %

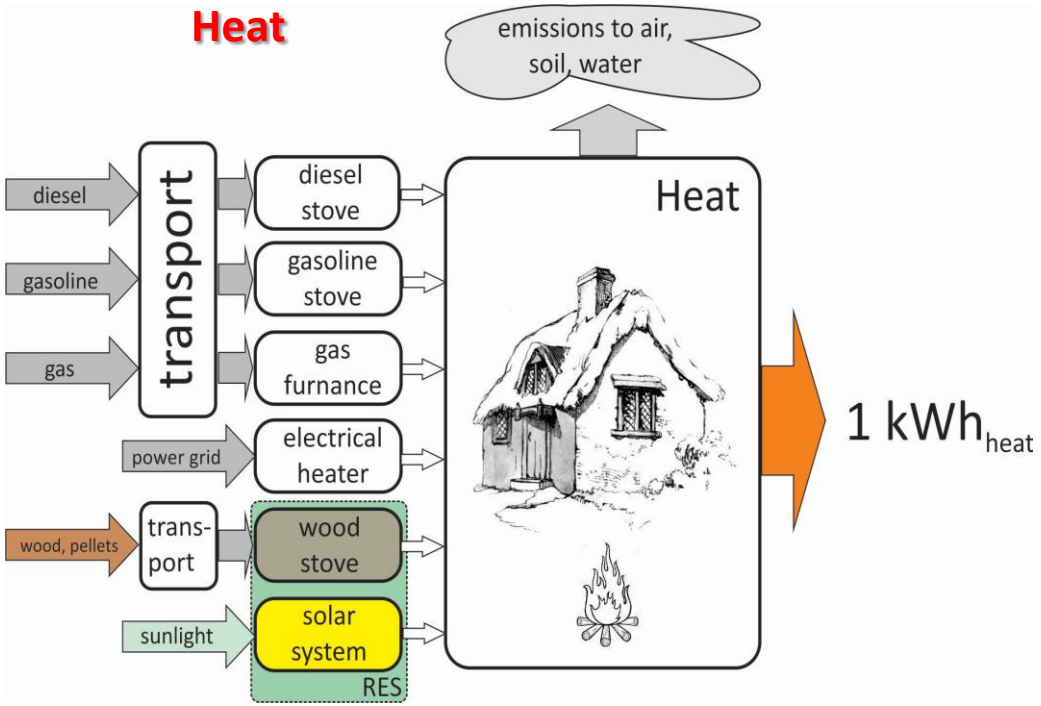
Fossil fuels

Evaluation of environmental impact

LCA – Life Cycle Assessment of mountain huts

General LCA model





Important parameters

- Operation time in year
- Number of visits in year
- The size of mountain hut
- Options for improvements

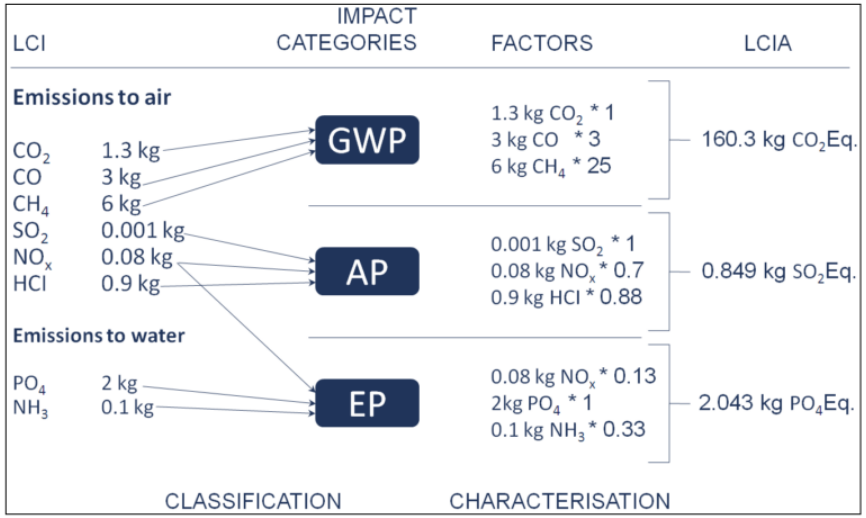
Comparison of results

- **Relatively** between huts according to the functional unit 1 kWh
- **Absolutely** according to the individual hut before and after the investment

Methodology/Environmental indicators

- CML2011
- Enviromental indicators (12 midpoint)
- Gabi Thinkstep
- Ecoinvent in Gabi professional

CML2001 and enviromental indicators



GLOBAL

- Global Warming Potential (GWP, kg CO_2- eq.)
- Abiotic Depletion Potential (ADP, kg Antimona (Sb) - eq.)
- Ozone Layer Depletion Potential (ODP, kg R11 - eq)

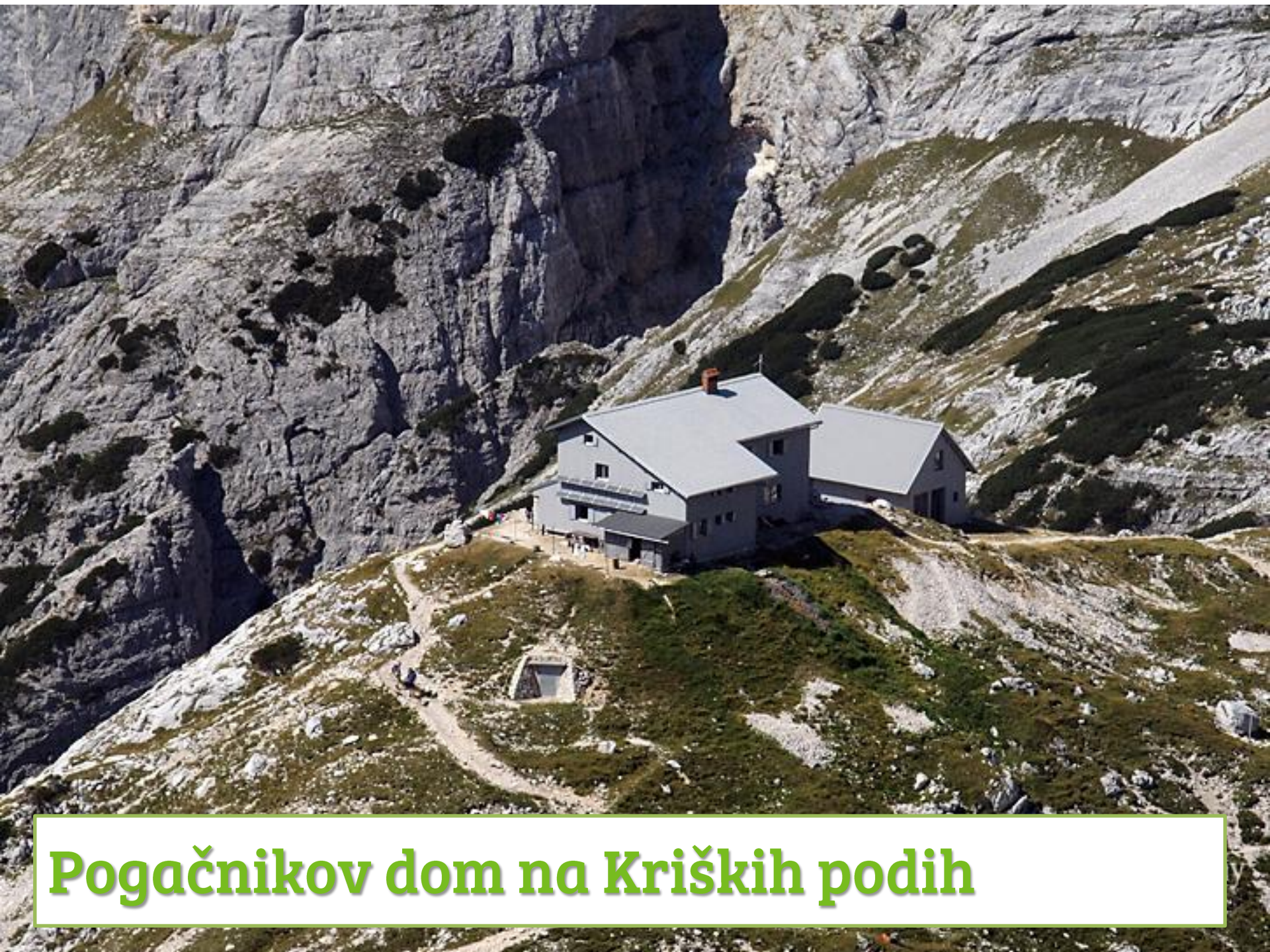
REGIONAL

- Acidification Potential (AP, kg SO_2 - eq.)
- Freshwater Aquatic Eco-Toxicity Potential (FAETP, kg DCB - eq.)

LOCAL

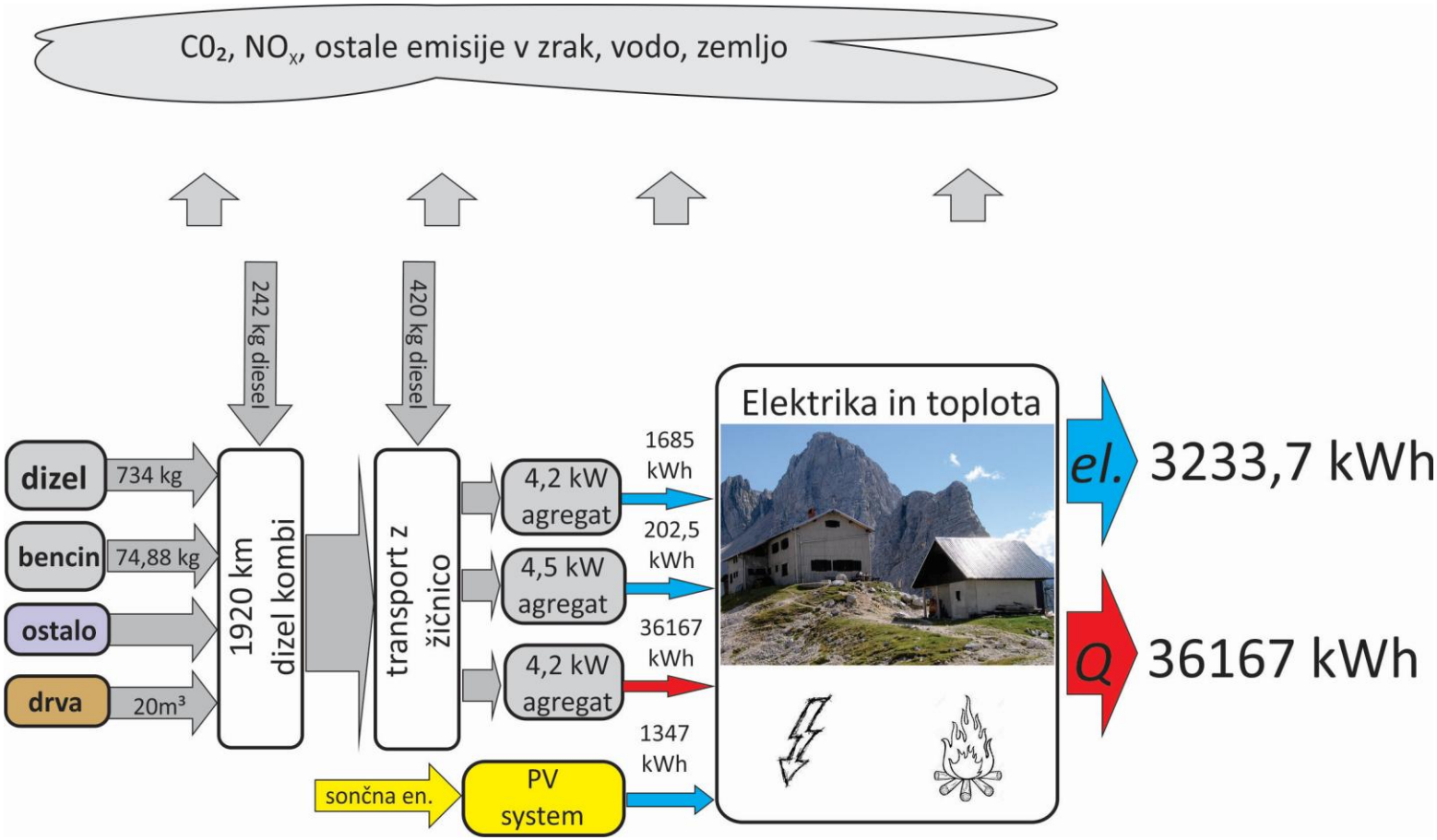
- Eutrophication Potential (EP, kg PO_4- eq)
- Photochemical Ozone Creation Potential (POPC, kg Etilen - eq.)
- Human Toxicity Potential(HTP, kg DCB - eq.)

CML 2001 (ang. Centre of Environmental Studies; University of Leiden, EU)



Pogačnikov dom na Kriških podih

Life Cycle Inventory



Estimated NO_x and CO_2 emissions

- Diesel generator➔ **2,64 kg/l (3,162 kg/kg)** CO_2
- Diesel generator➔ **2,392 kg/l (3,189 kg/kg)** CO_2
- LPG ➔ **3,027 kg/kg** de CO_2
- Helicopter ➔ **7 kg/min** CO_2

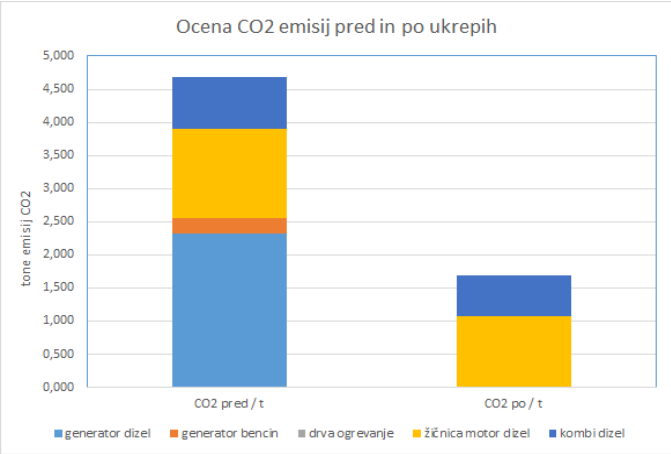
4678 kg / year

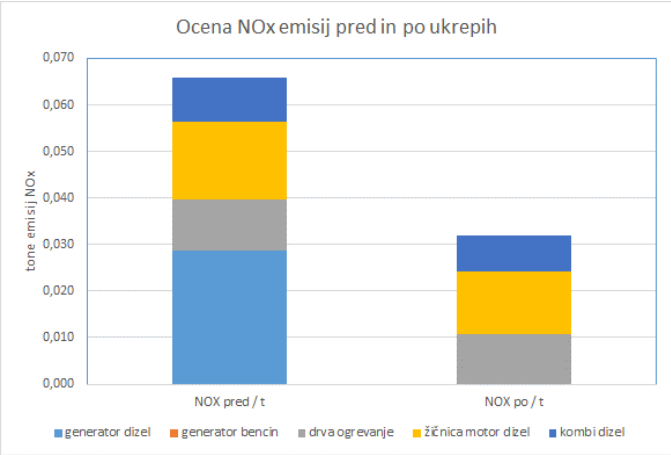
65,9 kg / year

CO_2

NO_x

Estimated emissions according to:





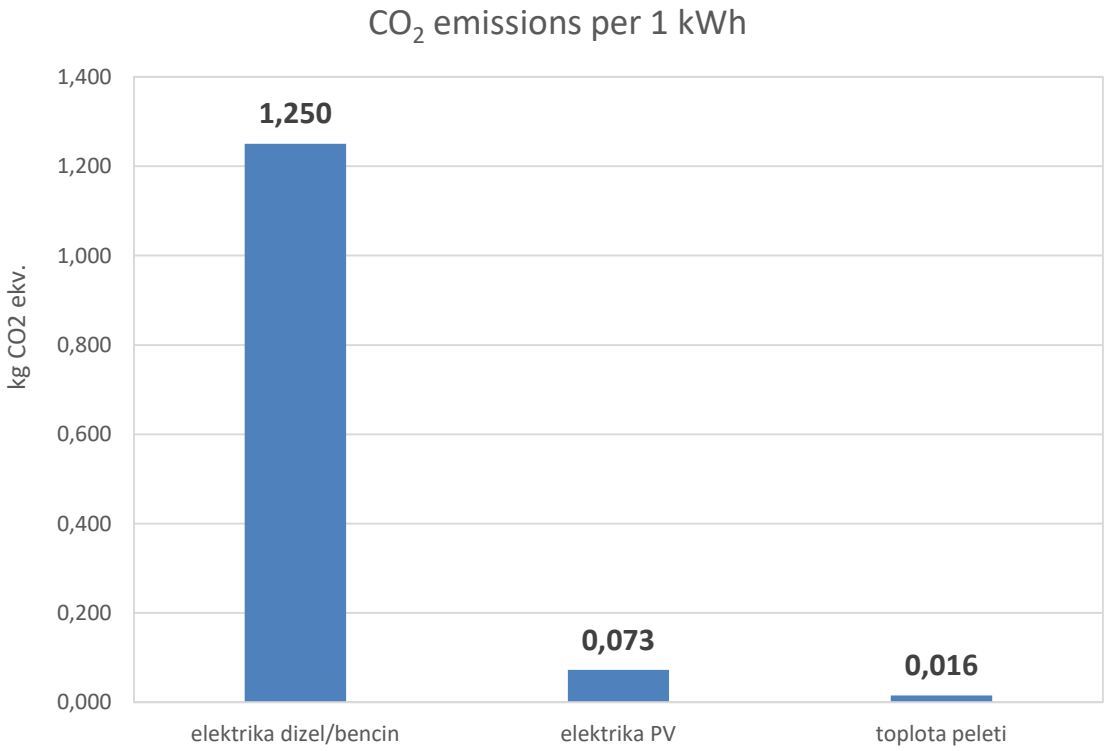
- Installation of 5.5 kW PV
- Non-operational diesel and petrol generators
- Transport optimization (20 % reduction in consumption: less fuel, optimization)

4678 kg / year → **1694 kg / year**

65,9 kg / year → **31,83 kg / year**

CO_2 **NO_X**

Results of in-depth LCA analysis



- Emissions are also present at
- Electricity production from PV
  - Heat from pellets
- Reasons?

Conclusions – Toward zero emissions?

A zero environmental impact can be achieved in the case of mountain huts, not just with technological measures, but also should be considered:

- to manage a hut economically by owners,
- cooperation of users of mountain huts – mountaineers (consumption (electricity/heat), waste, etc.)

Thank you for your attention!

Questions?

Contact: Mitja Mori (mitja.mori@fs.uni-lj.si)
coordinator: Pedro Casero (pcasero@hidrogenoaragon.org)
Web page: http://sustainhuts.eu/