European Commission

NRG2 PEERS

H2020 NRG2peers
(contract 890345)

Reshaping the Energy Market in Italy: Challenges and Opportunities

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EU SET-Plan Co-Chair IWG8 - Renewable Fuels for Sustainable Transports and Bioenergy

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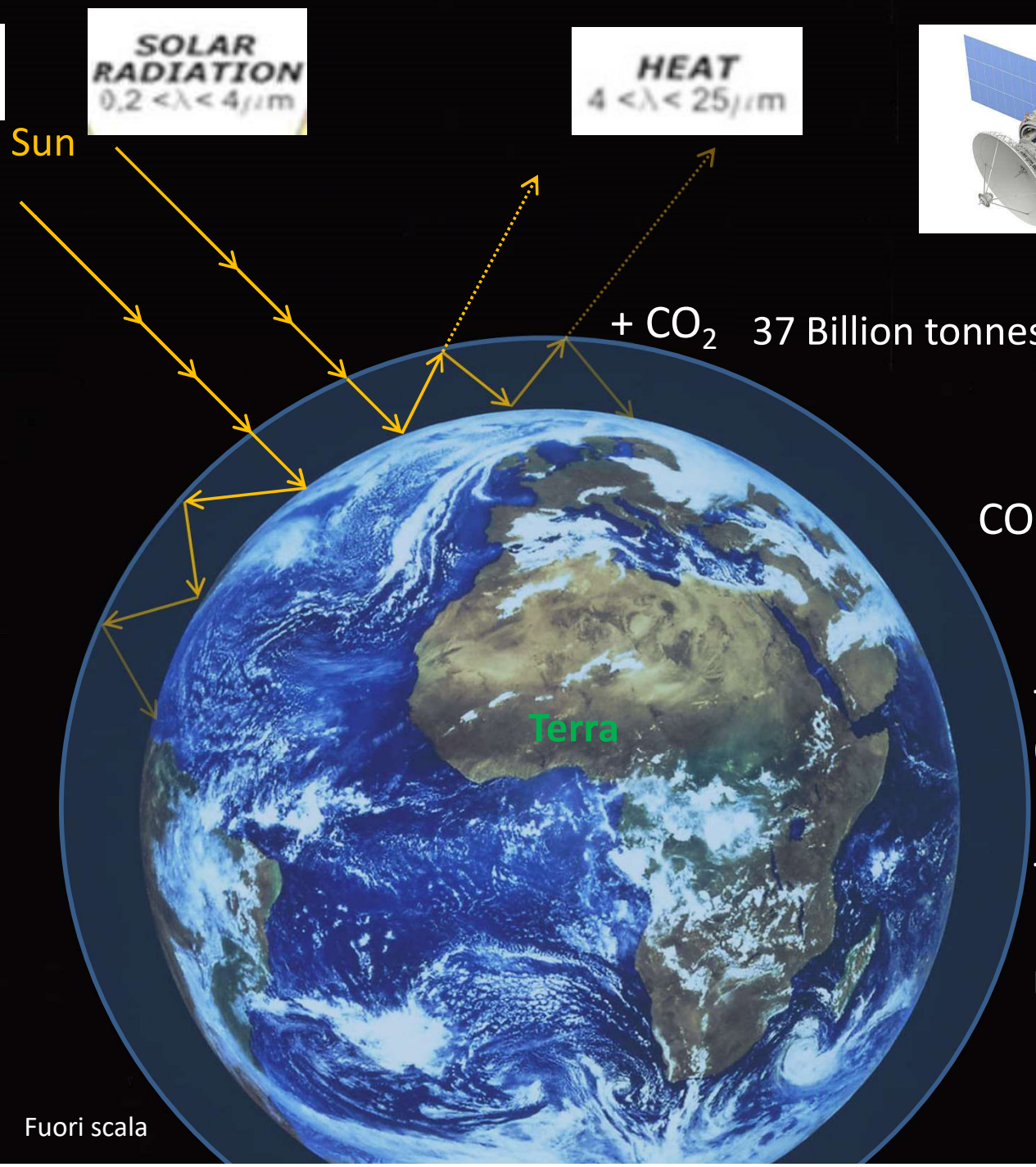
CIRIAF Centro Interuniversitario di Ricerca sull'Inquinamento e sull'Ambiente - mauro Felli

Centro Ricerca Biomasse CRB Biomass Research Centre

Energy and Climate Change



37 Billion tonnes/year

consequences

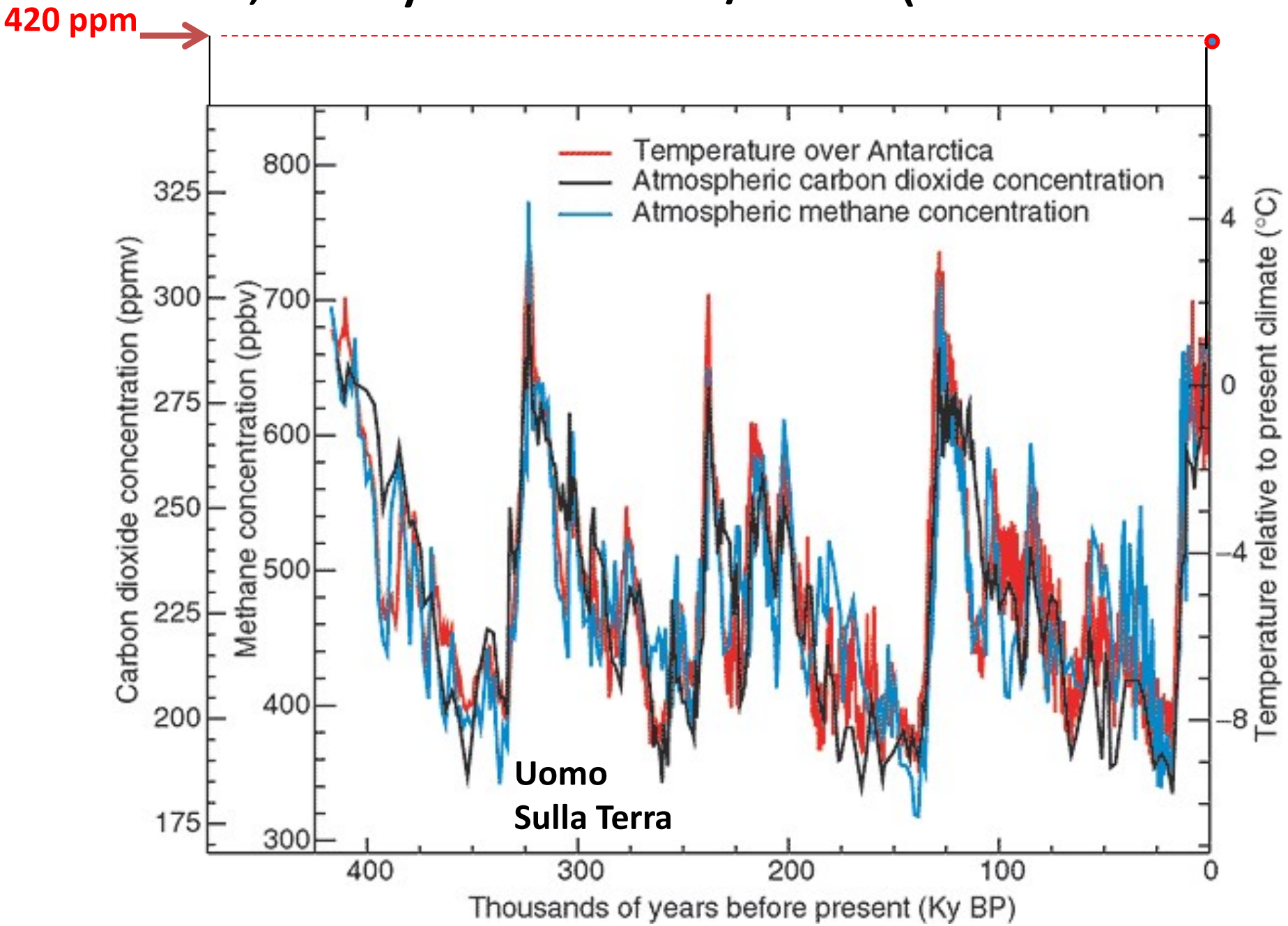
CO2 = + Energy = + Extreme events

+ Melting of perennial glaciers (2.5% fresh water)

+ Acidification of the oceans = Destruction of coral reefs and mollusc shells

Fuori scala

Temperature and CO2 variations over the last 400,000 years. +4°C/-9°C (Source: IPCC)

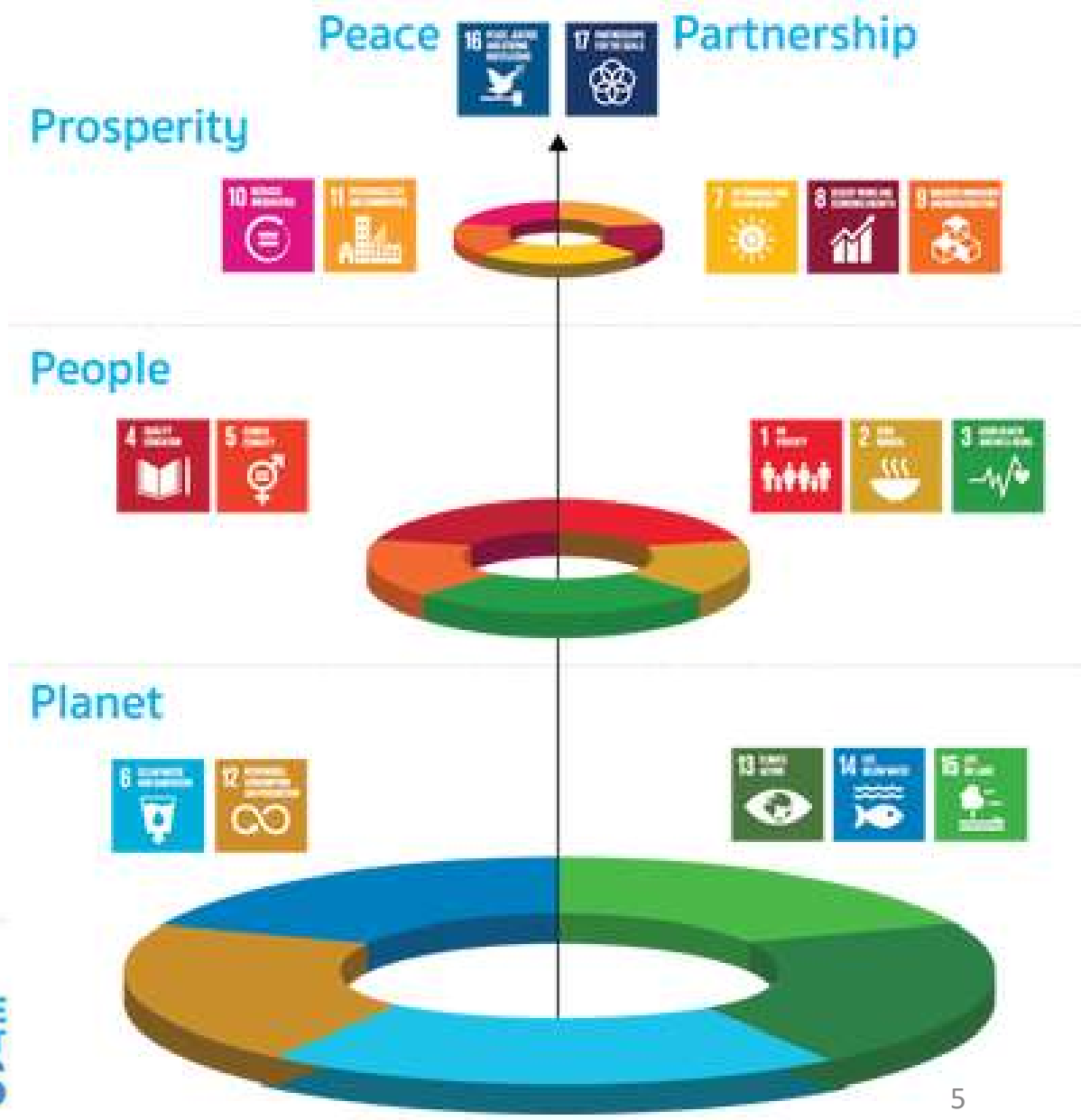


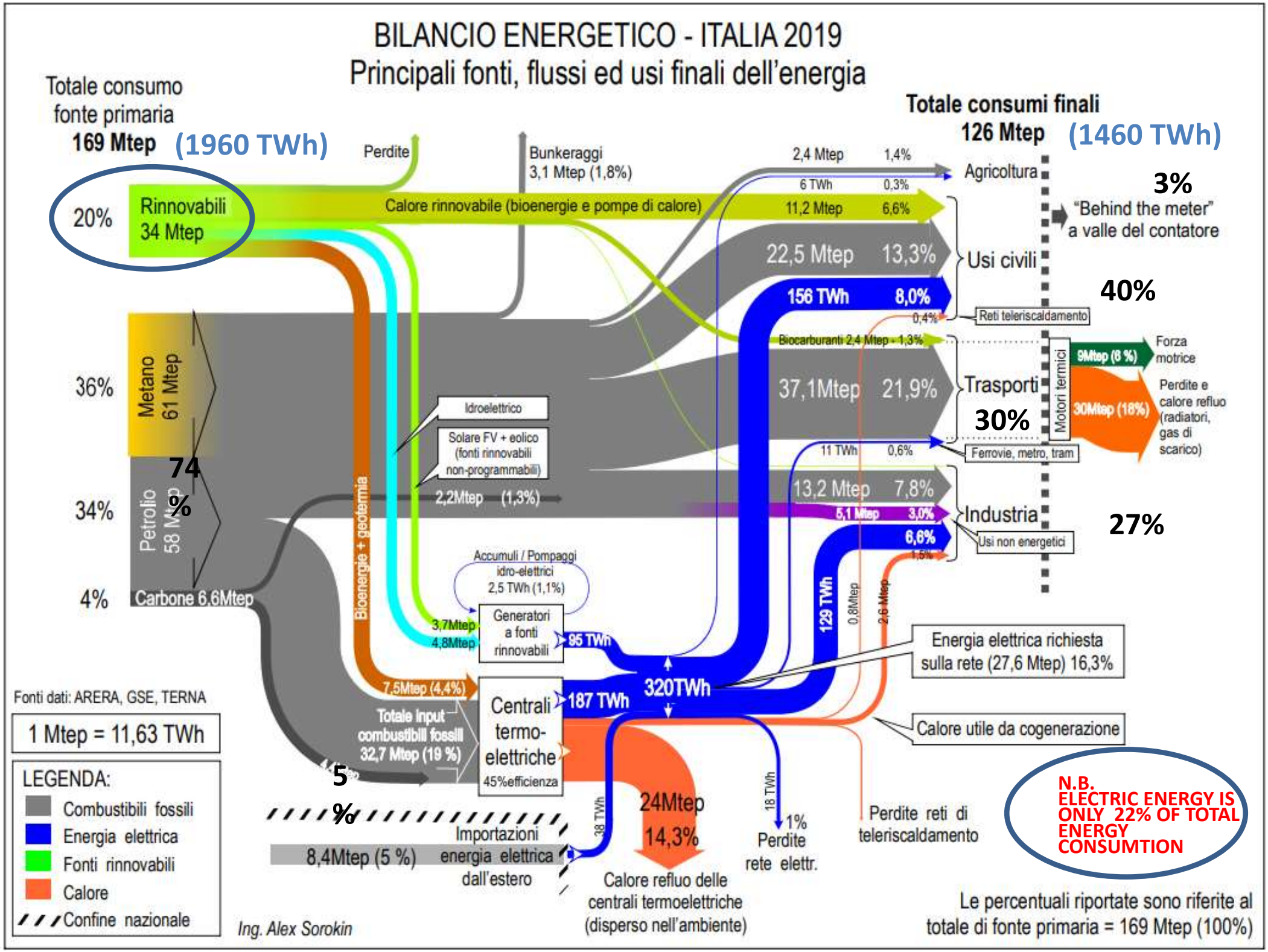
Energy transition and climate change 3 main pillars to consider

- **People** (8 billion population) +1.1%/Year
- **Planet** (37 billion tons/year of CO2 comes from fossil fuel use 14 billion TOE/year)
- **Prosperity** (world Gdp is over 96 trillion of dollars)

Renewable energy communities:
Towards a new generation of EU peer-to-peer Energy Communities facilitated by a gamified platform and empowered by user-centred energy trading mechanisms and business models

Energy 2 Peers - UN AGENDA 2030

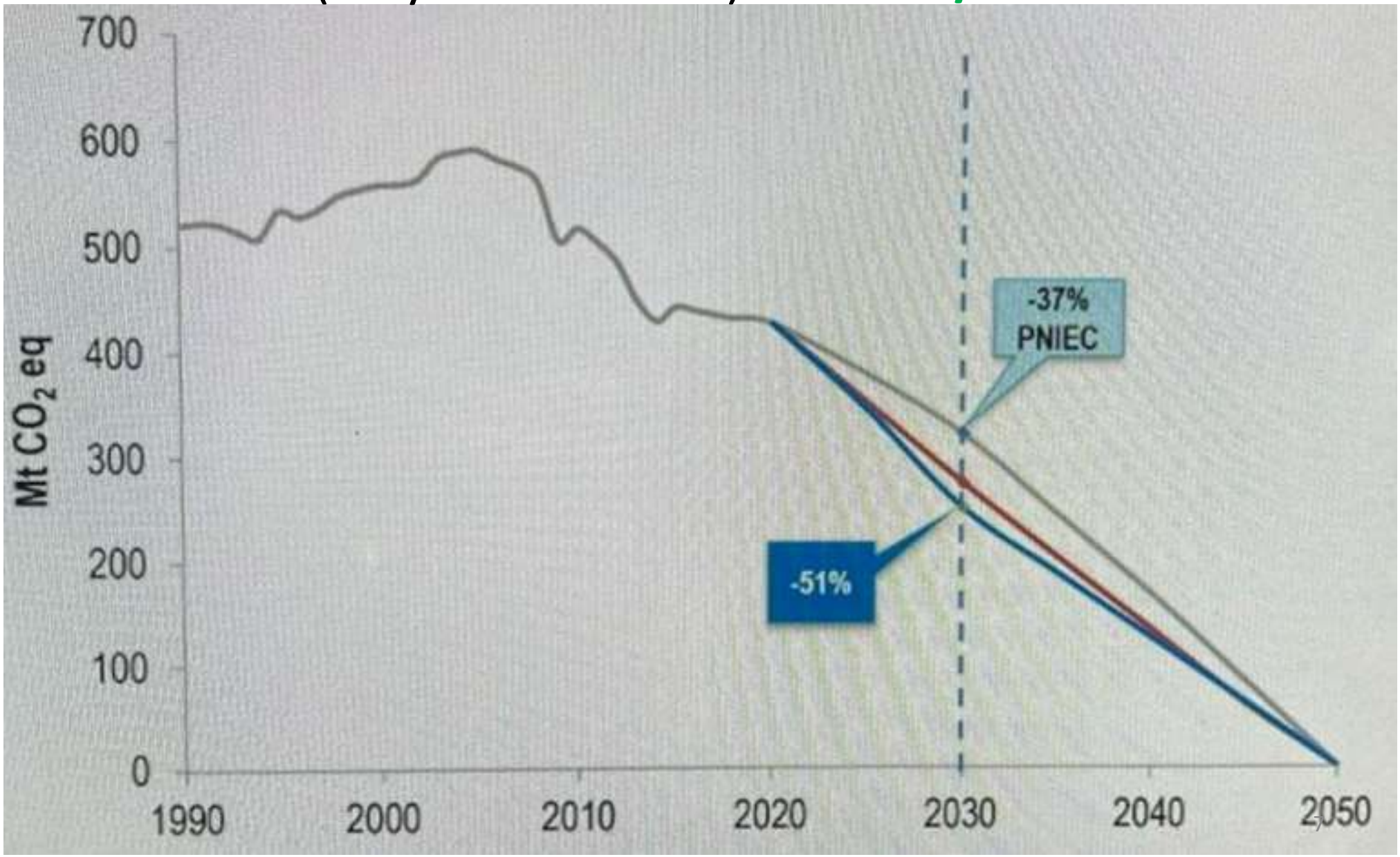



BILANCIO ENERGETICO - ITALIA 2019
Principali fonti, flussi ed usi finali dell'energia
Totale consumo fonte primaria
169 Mtep (1960 TWh)
Totale consumi finali
126 Mtep (1460 TWh)
20%
Rinnovabili 34 Mtep
Perdite
Bunkeraggi 3,1 Mtep (1,8%)
Calore rinnovabile (bioenergie e pompe di calore)
2,4 Mtep 1,4%
6 TWh 0,3%
11,2 Mtep 6,6%
Agricoltura
3%
"Behind the meter" a valle del contatore
40%
22,5 Mtep 13,3%
Usi civili
156 TWh 8,0%
0,4%
Reti teleriscaldamento
36%
Metano 61 Mtep
Biocarburanti 2,4 Mtep - 1,3%
37,1Mtep 21,9%
Trasporti
30%
Motori termici
9Mtep (8 %)
Forza motrice
30Mtep (18%)
Perdite e calore refluo (radiatori, gas di scarico)
Idroelettrico
Solare FV + eolico (fonti rinnovabili non-programmabili)
2,2Mtep (1,3%)
11 TWh 0,6%
Ferrovie, metro, tram
74 %
34%
Petrolio 58 Mtep
13,2 Mtep 7,8%
5,1 Mtep 3,0%
Industria
27%
6,6%
1,5%
Usi non energetici
4%
Carbone 6,6Mtep
Bioenergie + geotermia
Accumuli / Pompaggi idro-elettrici 2,5 TWh (1,1%)
3,7Mtep
4,8Mtep
Generatori a fonti rinnovabili
85 TWh
129 TWh
0,8Mtep
2,6 Mtep
Energia elettrica richiesta sulla rete (27,6 Mtep) 16,3%
7,5Mtep (4,4%)
Totale input combustibili fossili 32,7 Mtep (19 %)
Centrali termo-elettriche 45%efficienza
187 TWh
320TWh
Calore utile da cogenerazione
5 %
38 TWh
24Mtep 14,3%
18 TWh
1% Perdite rete elettr.
Perdite reti di teleriscaldamento
N.B. ELECTRIC ENERGY IS ONLY 22% OF TOTAL ENERGY CONSUMTION
Importazioni energia elettrica dall'estero
8,4Mtep (5 %)
Calore refluo delle centrali termoelettriche (disperso nell'ambiente)
Fonti dati: ARERA, GSE, TERNA
1 Mtep = 11,63 TWh
LEGENDA:
Combustibili fossili
Energia elettrica
Fonti rinnovabili
Calore
Confine nazionale
Ing. Alex Sorokin
Le percentuali riportate sono riferite al totale di fonte primaria = 169 Mtep (100%)

Italian Decarbonisation scenarios to 2050

PNIEC -40%of CO2 (Italy -37%) **EU fit for 55/2021**:

14 directives (Italy -51%of CO2) **…10 GW/Y** new**RES !?**



2050 : Italian economy decarbonization
CRB scenario Next 27 y

a) **Energy efficiency +30%:** reduction of energy consumption : from 125 Mtoe/y to **90 Mtoe/y**

b) **Renewable energy production + 77% : +70 Mtoe/y** (RE today **34** Mtoe/y)..

Il mix di energie rinnovabili sfruttabile annuo per la decarbonizzazione:

- **Wind Energy** (Eolico): + **10,0%** (**9** Mtoe/y)
- **Hydroelectric Energy** (Idroelettrico): + **2,0%** (**1,8** Mtoe/y)
- **Photovoltaic energy** (Fotovoltaico): + **35,0%** (**31,5** Mtoe/y _ 280 GWp 170.000 ha)
- **Biomass energy** (Biomasse - incluso biogas): + **15,0%** (**13,5** Mtoe/y)
- **Geothermal energy** (Geotermia a alta entalpia): + **1,5%** (**1,35** Mtoe/y)
- **Low enthalpy Geothermal energy** (Geotermia a bassa entalpia)

Thermal uses – heating , heat pump: + **12,0%** (pari a **10,8** Mtoe/y)

-Waste (9 Mton/y indiff=3Mton **CSS**): + **1,5%** (pari a **1,35** Mtoe/y)

The 18% of tot **FER are green Hydrogen** (**16** Mtoe/y = 5,4 Mil ton/y H_2 # **60% Bio-H2**)

Tot. increase RE **+77% (+70 Mtoe/y)**

RE today **+ 23%** (**34** Mtoe/y)..

c) **Smat Grid improvement and enhancement (MT, AT)**

d) **Energy storage (electrochemical, Hydro pumping , Thermal..) & local thermal grid**

The role of renewable energy communities in the decarbonisation of the European and Italian economies

Renewable Energy Communities are legal, technical and social entities that provide for the active participation of citizens and/or public and/or private entities in the energy system. Community benefits can be pursued through collaboration between members:

Social, (**People**): By involving people, there is greater awareness of the importance of energy and social acceptability of the power plant.

Environment, (**Planet**): global warming mitigation reducing CO2 emissions

Economic, (**Prosperity**): reduction of energy costs ancd self-financing tanks also to the incentives on shared energy and self-consumtion

Renewable Energy Communities (CER), the EU context

Direttive RED II (Direttiva UE 2018/2001)

30% total energy from RES by 2030

transposition by Italian legislation

towards an energy market that is centered on the consumer/citizen, coming to envisage ways of exchanging energy between "peers" (P2P)

Decreto Milleproroghe
convertito nelle **Legge n. 8/2020**
regolamentato con delibera
ARERA 318/2020/R/eel

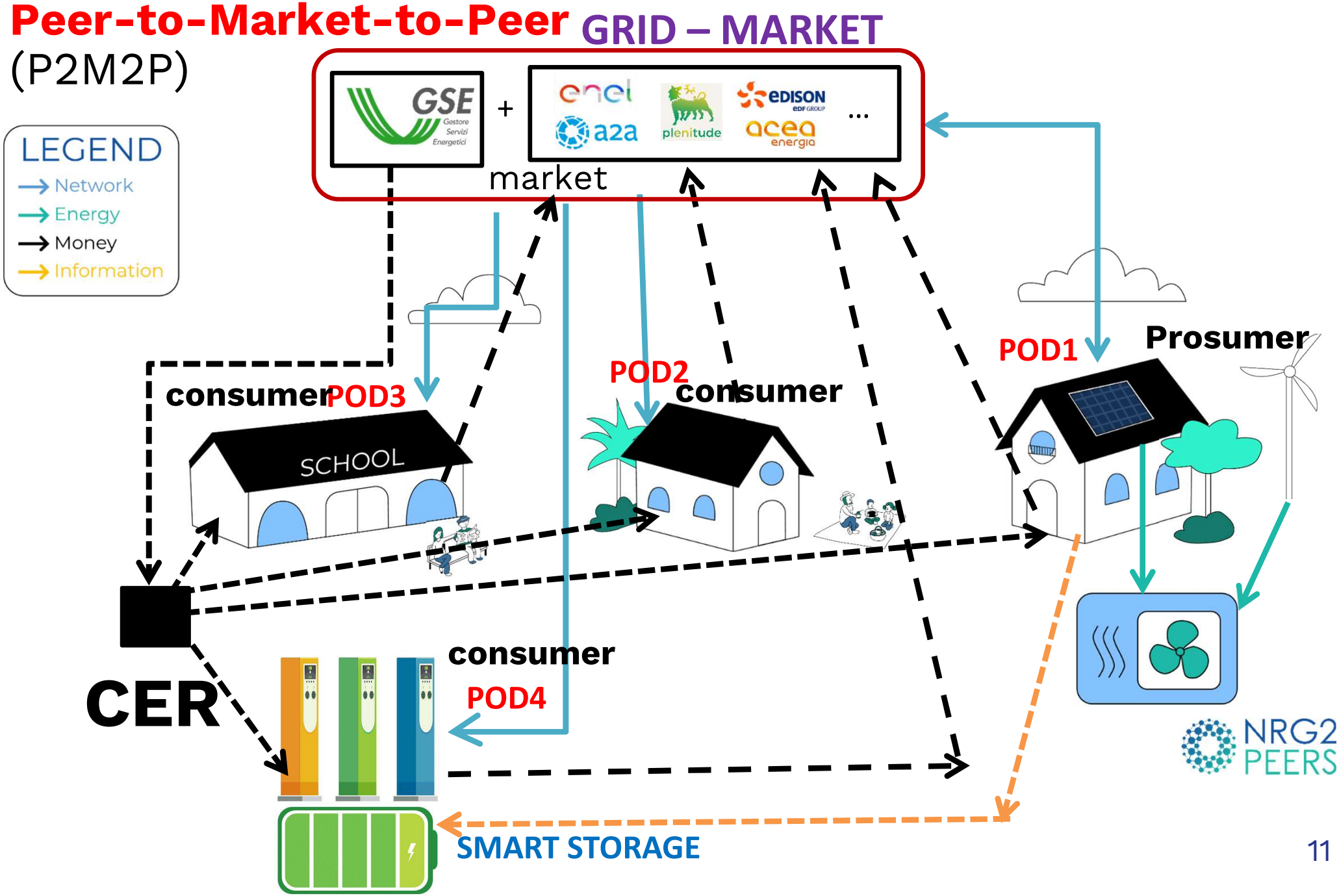
Guidelines:

linee guida per evolvere verso un mercato dell'energia che sia incentrato sul consumatore/cittadino, arrivando a prevedere **modalità di scambio di energia tra «pari» (P2P)**

[RED II, Art.21, 2(a)]

Italian Model of renewable Energy communities

Peer-to-Market-to-Peer (P2M2P)



Biomass for Energy/bio-Hydrogen/Biomethane Power and District heating 30% of Italian Energy Plan

1. Herbaceous crops in Marginal Land for BIOMETANE

Cardum

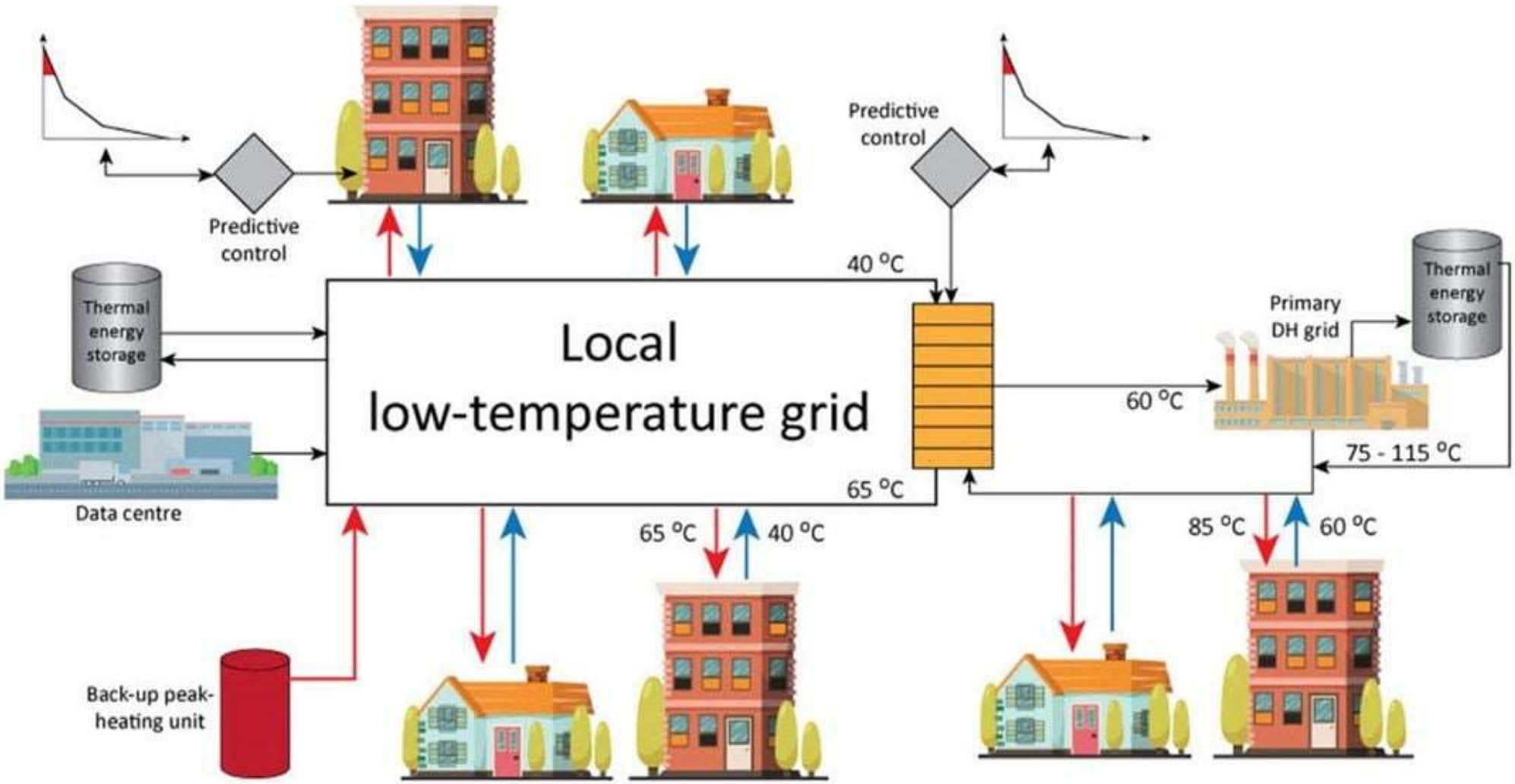
wild boars avoid them !!

Cartamus

2. Lignocellulosic biomass for Syngas

Wood chips

Local Thermal Energy Comunity



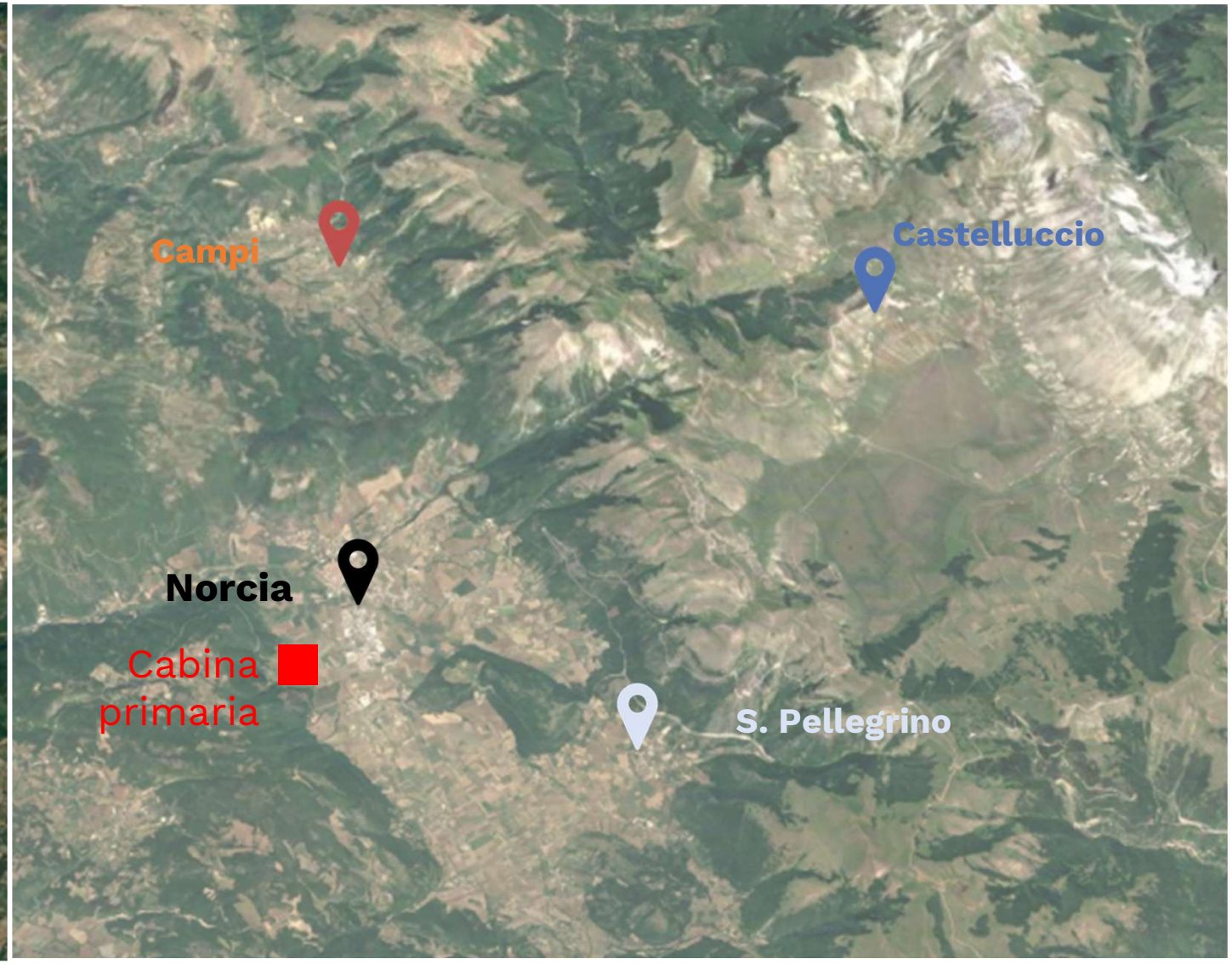
Umbria- Norcia Sustainable Valley

Renewable Energy Communities

Where: Norcia city and villages (Campi, San Pellegrino, Castelluccio)

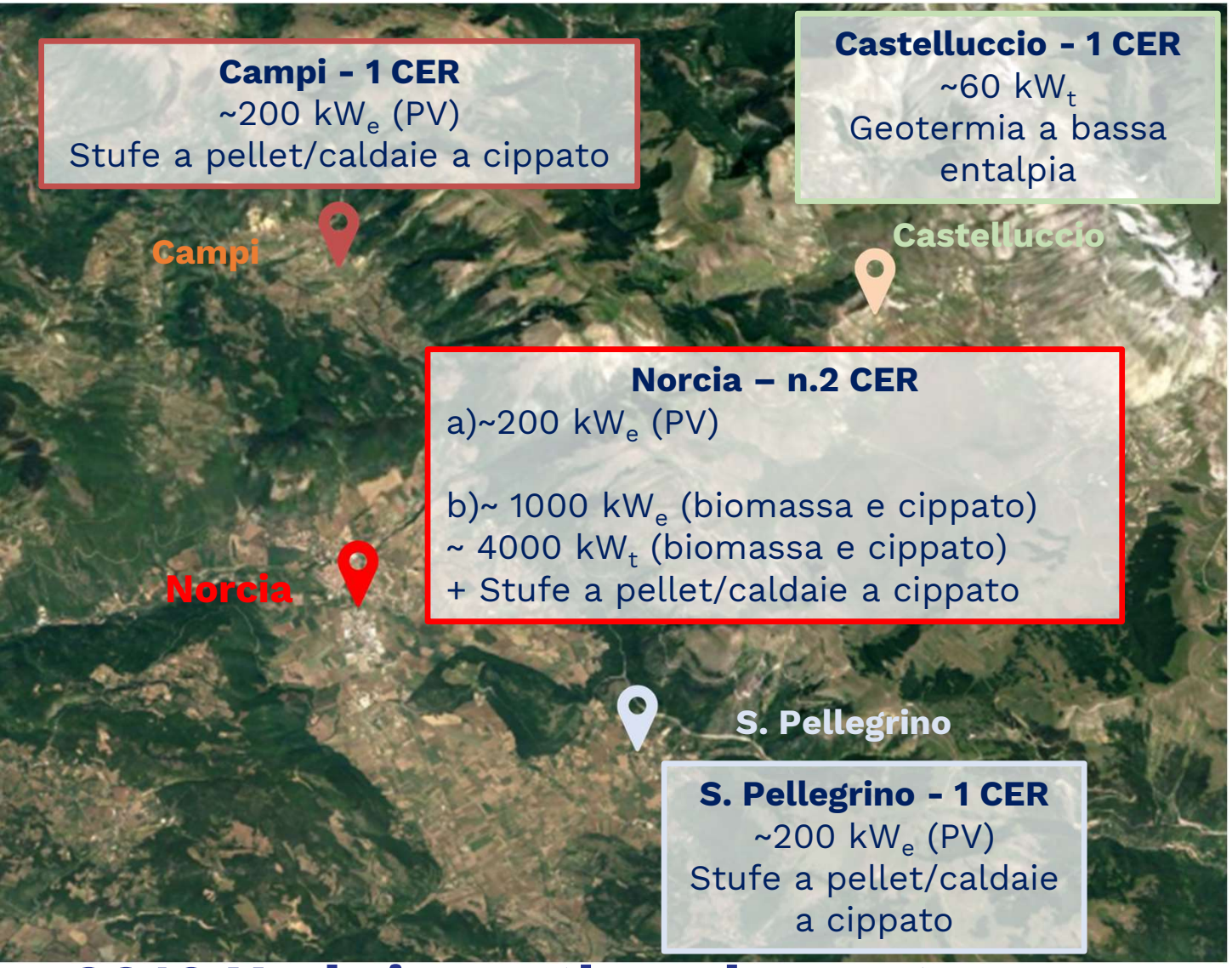
- **Biomass**
- **Photovoltaic**
- **Heat Pump with Geothermal**

2016 Umbria earthquake crater area



Rebuilding after the earthquake with Renewable Energy Communities

Norcia Sustainable Valley



2016 Umbria earthquake crater area

Project Norcia
n.5 CER
Renewable
Energy
Communities

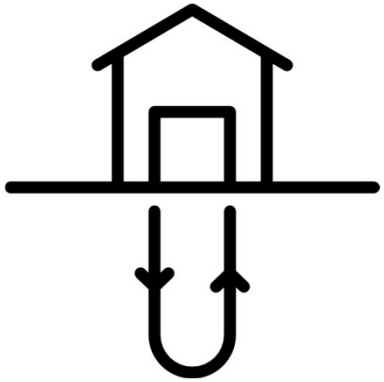
(kW$_e$
200+200+200+
200+1000)

1800 kW$_e$ +
4060 kW$_t$ =
5860 kW$_{t+e}$

1. Biomass for Power and District heating
2. Photovoltaic plant

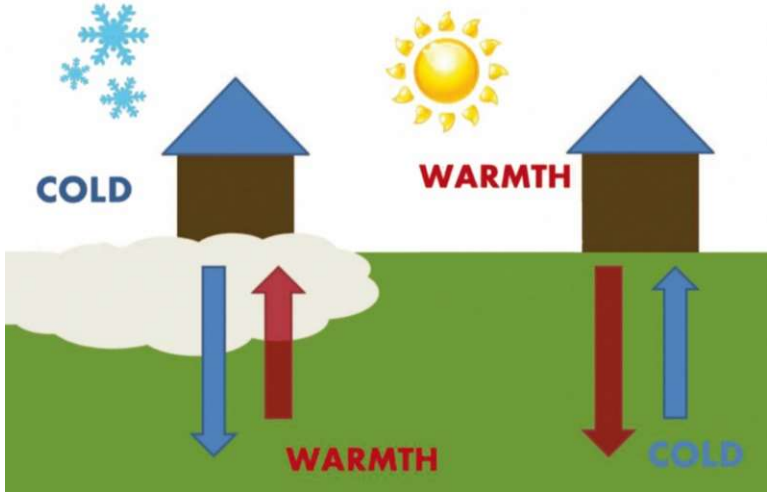
Geothermal plant for heat pump in Norcia-Castelluccio village

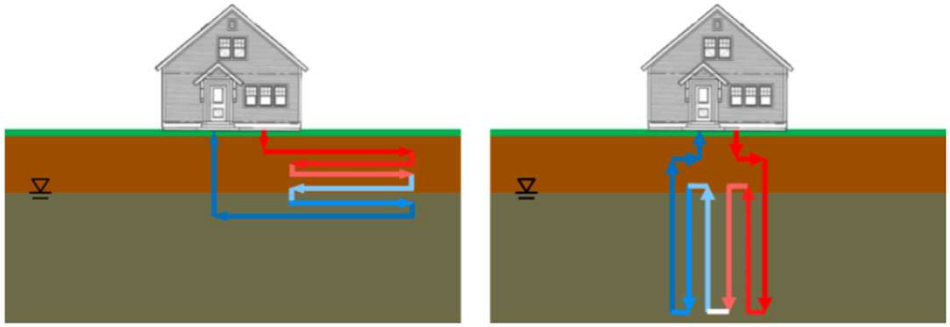
Low-enthalpy geothermal energy uses the ground as 'thermal storage', extracting heat in winter and releasing it in summer



Components:

- Heat Pump
- Geothermal probes
- Storage tank
- Heat distribution system

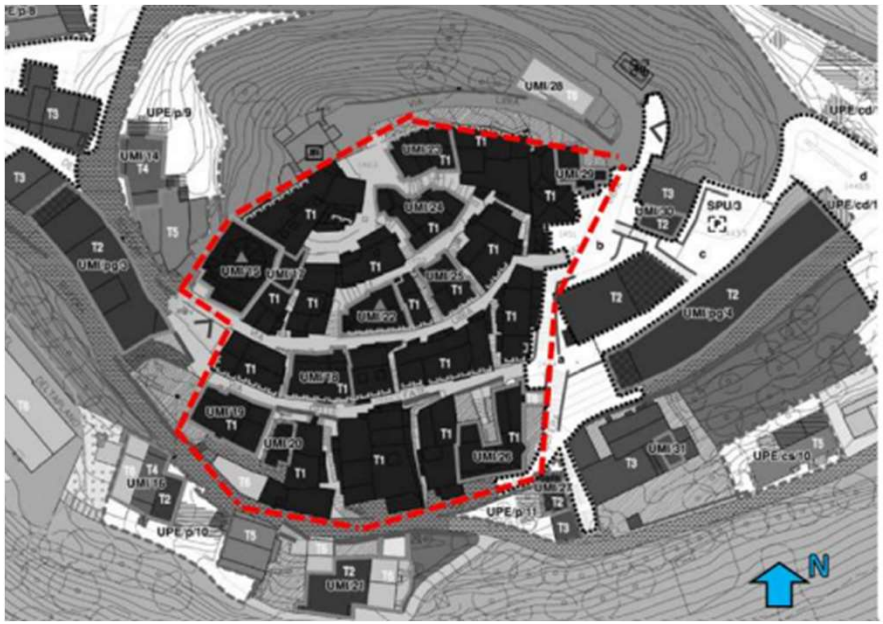




TYPES of geothermal heat exchange:

- Horizontal collectors
- Vertical collectors
- Groundwater ("open loop")
- Energy piles or geostructures

Low-enthalpy geothermal energyDesign hypothesis for the case of Castelluccio di Norcia



Castelluccio di Norcia, 600-square-metre geothermal system under the earthquake-proof platform with seismic isolators

Example of Geotermal plant at CRB's operative facility in Sant'Apollinare village

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Grazie!

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