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SEMANCO2
SEMANTIC TECHNOLOGIES FOR CO2 REDUCTION IN URBAN PLANNING

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SEMANTIC TECHNOLOGIES FOR CO_2 REDUCTION IN URBAN PLANNING

Semantic Technologies for Carbon Reduction in Urban Planning

Small or medium-scale focused research project (STREP)

ICT Call 7 FP7-ICT-2011-7

Work programme

ICT-2011.6.2 ICT Systems for energy efficiency

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PARTNERS

• **Enginyeria i Arquitectura La Salle** (FUNITEC), SPAIN, **University of Teeside** (UOT), United Kingdom, **Centro Internacional de Métodos Numéricos en Ingeniería** (CIMNE), SPAIN, **Politecnico di Torino** (POLITO), ITALY, **Hochschule Albstadt-Sigmaringen** (HAS), GERMAN, **Agency9**, SWEDEN, **Ramboll**, DENMARK, **Foment de la Rehabilitació Urbana de Manresa** (FORUM), SPAIN, **National Energy Action** (NEA), UNITED KINGDOM

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PROJECT VISION

Rational:

-Developing and implementing measures to achieve the EU energy and climate change targets for 2020 (20% reduced energy consumption – 20% reduced CO_2 emissions – 20% use of renewable energies)

- Implementing the policies and regulations established by the Renewable Energy Directive (RED), and Energy Performance Building Directive (EPBDrecast) in the member states

- Promoting the application of the Cogeneration Directive to save energy and combat climate change

PROJECT OBJECTIVE

Development of a system approach to grasp the complexity of issues involved in CO_2 reduction in urban planning requires:

- **identifying** CO_2 reduction potentials;
- **adapting** the potential to specific sites, in different climates;
- **devising** relevant measures to realize the potentials;
- **quantifying** the economic and environmental impacts.

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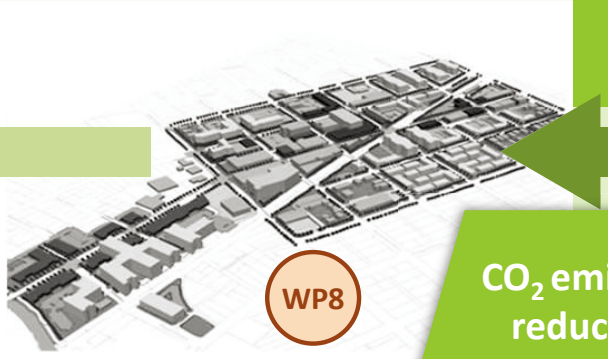
PROJECT APPROACH



WP8

CO_2 emissions reduction!

WP6

Decision Support System

Application domains

Regulations | Planning strategies | Urban Developments | Building Operations

Stakeholders

Policy Makers | Planners | Designers/Engineers | Building Managers | Citizens

Visualization Tools | Simulation Tools | Analysis Tools | Optimization Tools | Planning Tools

WP5

Technological Platform

SEMANTIC ENERGY INFORMATION FRAMEWORK (SEIF)

WP4

Building repositories | Energy data | Environmental data | Economic data

WP3

WP2

TECHNOLOGICAL PLATFORM: Semantic Energy Information Framework

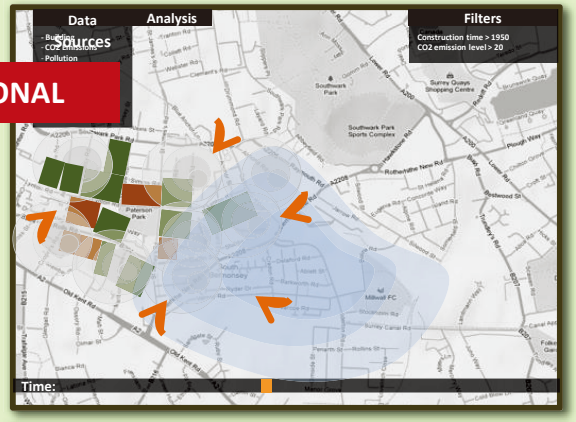
•The **Semantic Energy Information Framework (SEIF)** integrates **energy related data** with a set of tools for **visualizing**, **simulating** and **analyzing** the multiple interrelationships between factors determining CO_2 production.

•The semantic mapping acts as a bridge between different kinds of **data** (consumption data, pollution sources, simulated energy profiles and benchmarks), **domains** (city planning and energy provision) and geographic **scales** (regional, municipal, neighborhood).

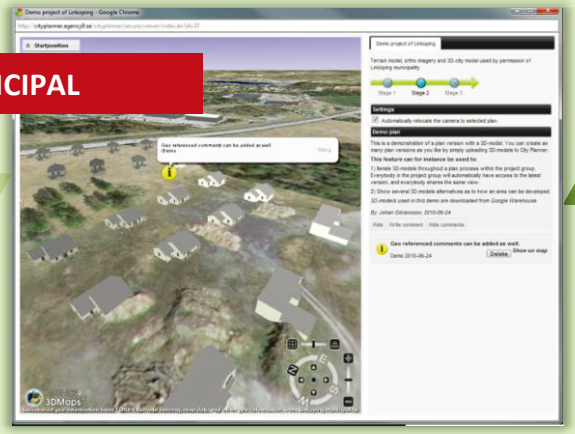
•The semantic framework models the data to be used by the tools which will support **decision making** by different stakeholders involved in urban planning.

TECHNOLOGICAL PLATFORM

REGIONAL



MUNICIPAL



NEIGHBORHOOD

ACCESS TO SEMANTICALLY MODELLED ENERGY DATA

OUTCOMES FROM TOOLS IMPROVE ENERGY MODEL

ENERGY PROFILES ASSOCIATED TO BUILDINGS TYPES CALCULATED BY TOOLS

RETRIEVING DATA ACROSS DIFFERENT GEOGRAPHIC SCALES

Ontology Repository

O1 O2 O3 O4 O5 O6

Open Linked

Environmental data

Economic data

Energy data

Building repositories

TOOLS (visualization, analysis, optimization)

Semantic Energy Information Framework (SEIF)

Distributed repositories of energy related information

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TECHNOLOGICAL PLATFORM: Energy data

Indicators for the monitoring and evaluation of energy efficiency and CO_2 emissions include:

- Energy/CO_2 intensities
- Specific energy consumption
- Energy efficiency indices by sector to evaluate energy efficiency progress (in %).
- Energy savings to measure the amount of energy saved through energy efficiency improvements.
- Adjusted indicators to allow the comparison of indicators across countries.
- Benchmark/target indicators by sector
- Indicators of diffusion to monitor the market penetration of energy-efficient and renewable energy technologies

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TECHNOLOGICAL PLATFORM: Tools

Existing commercial and open source technological solutions will be integrated in the platform, including:

1. **Energy simulation and visualization tools** to automate the identification and classification of domestic and non-domestic building stock -using image recognition and map digitization techniques- and to integrate the acquired data in the semantic model.
2. **Advanced energy information analysis tools** using data mining techniques will enable transformation and analysis of multidimensional datasets to infer knowledge in the form of rules, inherent relations or classifications.
3. **Interactive urban design tool** will enable planners to explore and evaluate different arrangements of buildings in project areas and evaluate their energy efficiency according to different parameters (e.g. envelope surface, sunlight exposure, embedded energy, investment costs…)

Building Stock Energy Modelling Tool

- Domestic stock energy modelling - using the energy equations provided in Reduced Data Standard Assessment Procedure [RdSAP]
- Following information is required:
  - Property Description – Dimensions, storeys, etc.
  - Type – Age, form, etc.
  - Location – Degree day, wind speed, site exposure, etc.
  - Conservatory & extensions
  - Construction type of walls, roofs & windows
  - Types of heating & fuel
  - Occupancy & usage

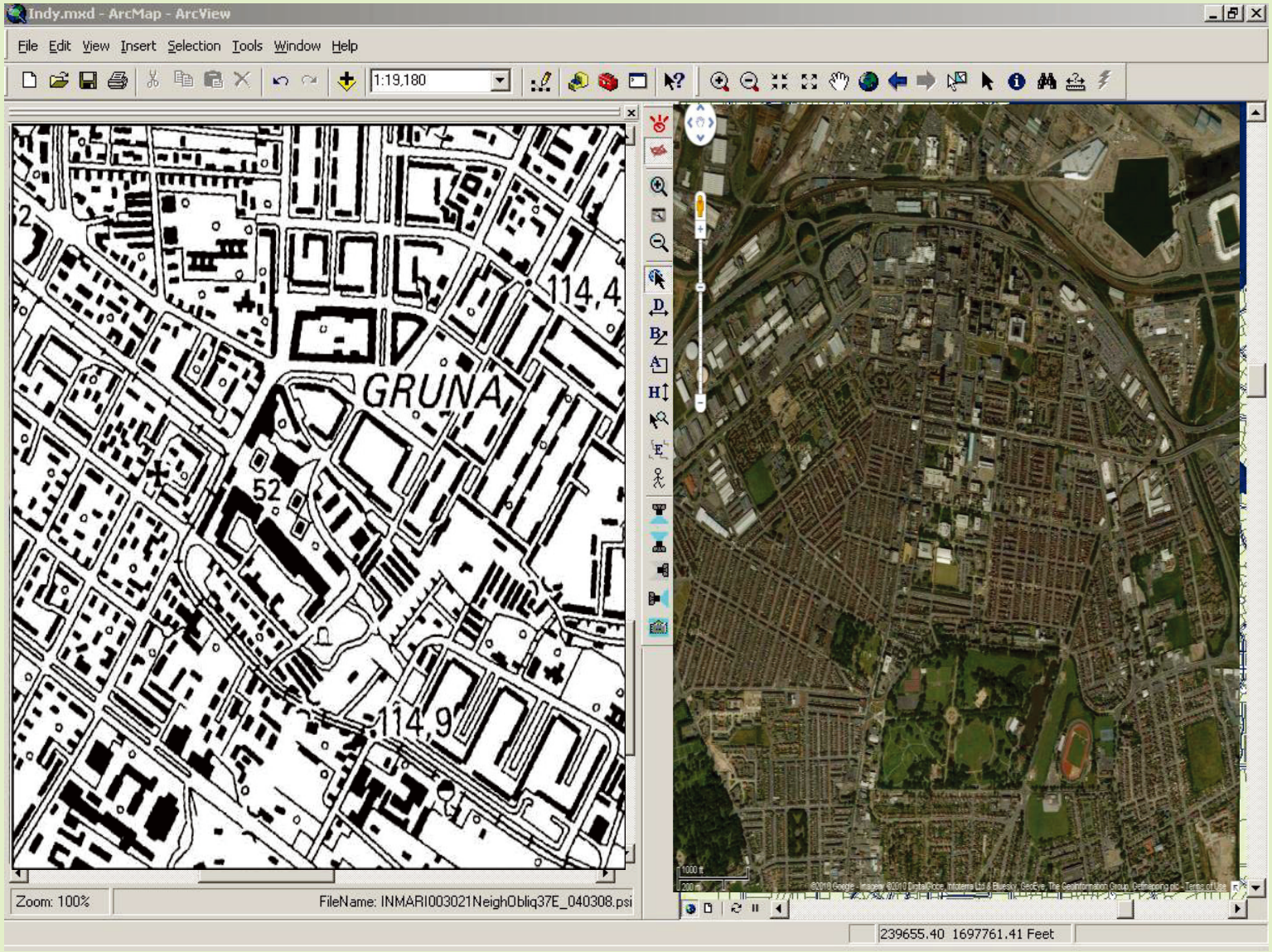
Source of Information

- Property footprint conservatory, extension & location can be derived from Ordinance Survey (OS) MasterMap or UKMap Data
- Heating, fuel used, occupancy and usage type can be derived from the data from Office of National Statistics
- We are looking to use aerial imagery and image recognition to fill in the missing data i.e. height of buildings & construction type

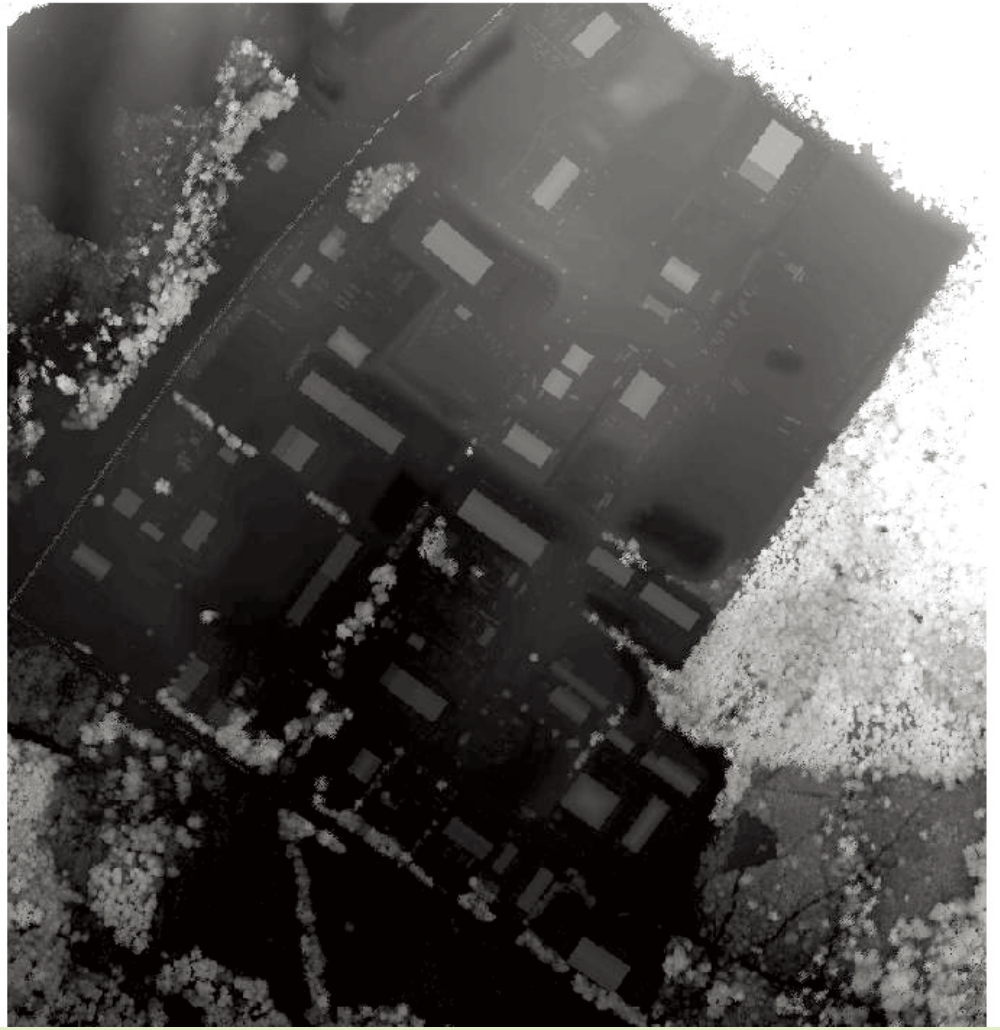
Software Integration

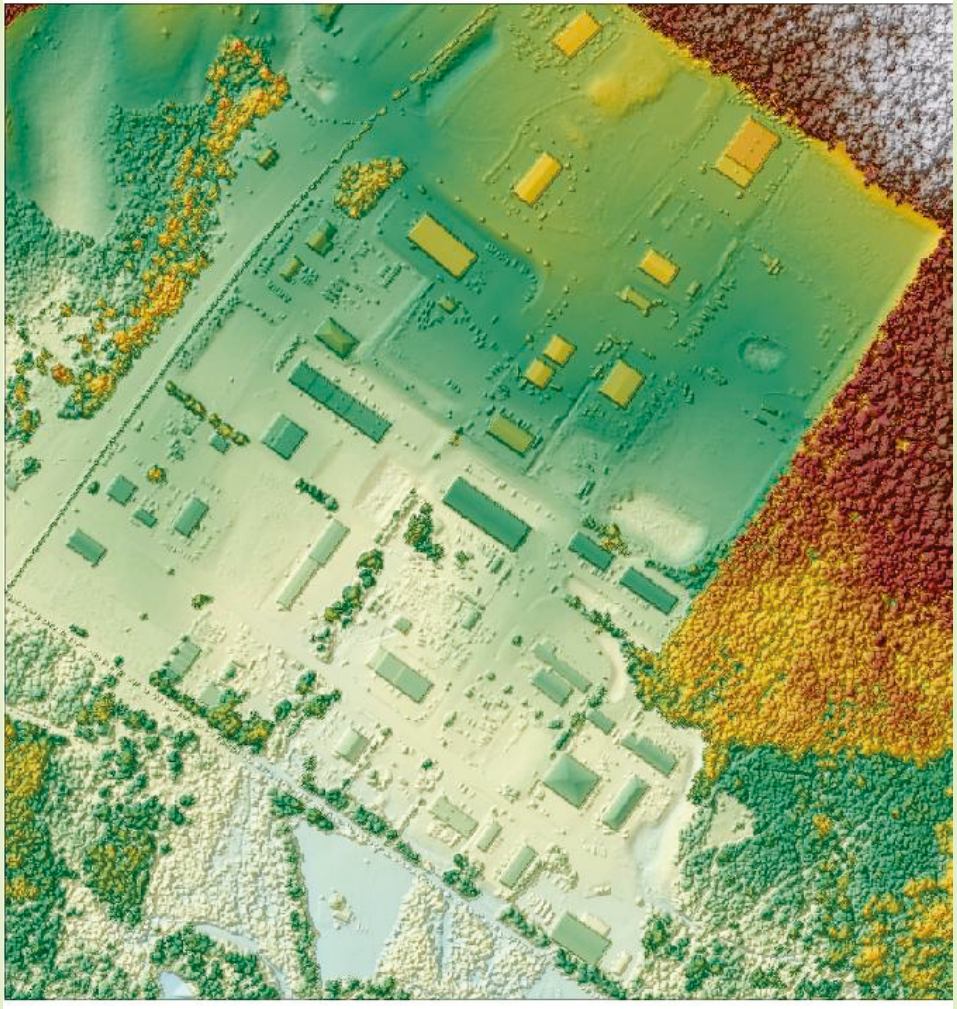
- To enable neighbourhood level energy modelling, it is proposed to use Geographic Information System (GIS) software, ArcGIS, UC/win-Road
- The software systems inherent data repository capabilities and can access information from OS maps
- The software however lacks the capabilities such as image recognition, which can be extended using add-ons such as HALCON and LIDAR / Image ANALYST

T5.1 OS MasterMap & Aerial Imagery in ArcGIS

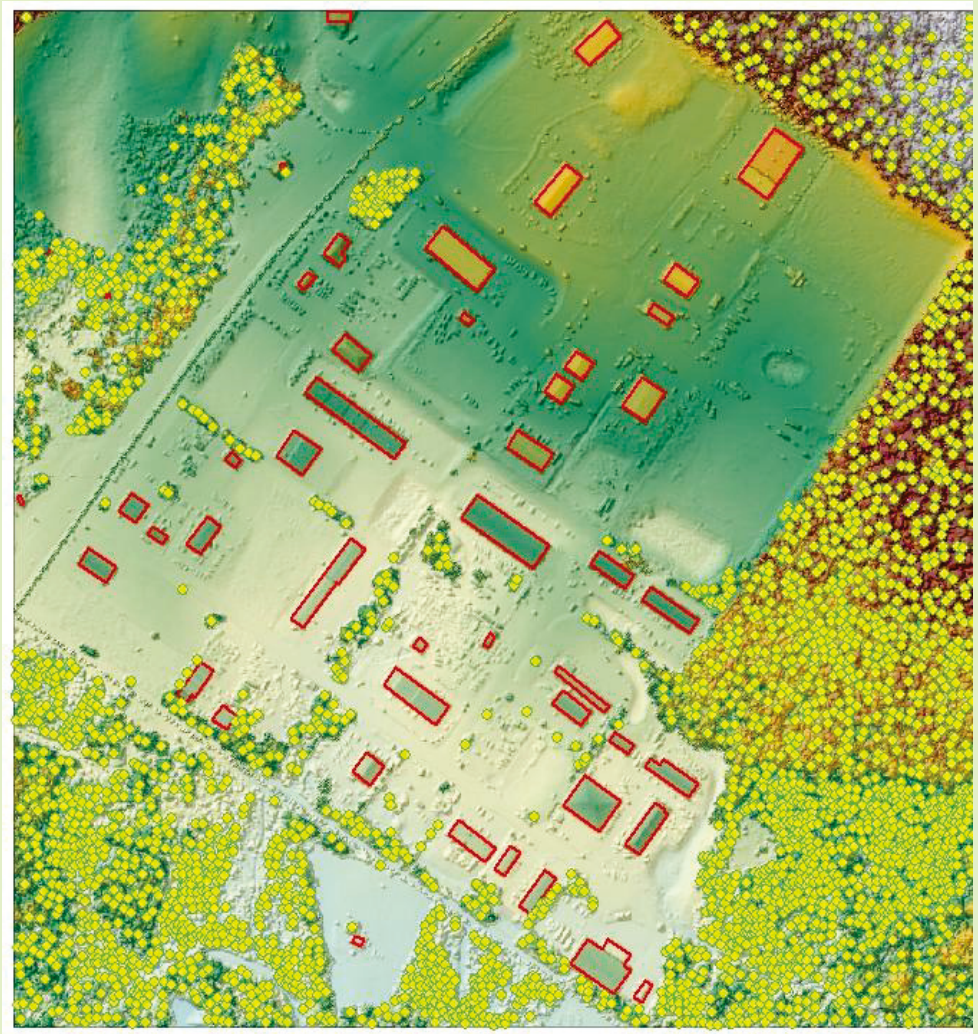


T5.1 Image Recognition using LIDAR Analyst





Processed Image



3 case study scenarios in UK, Spain and Denmark including both existing and new urban areas will contribute to:

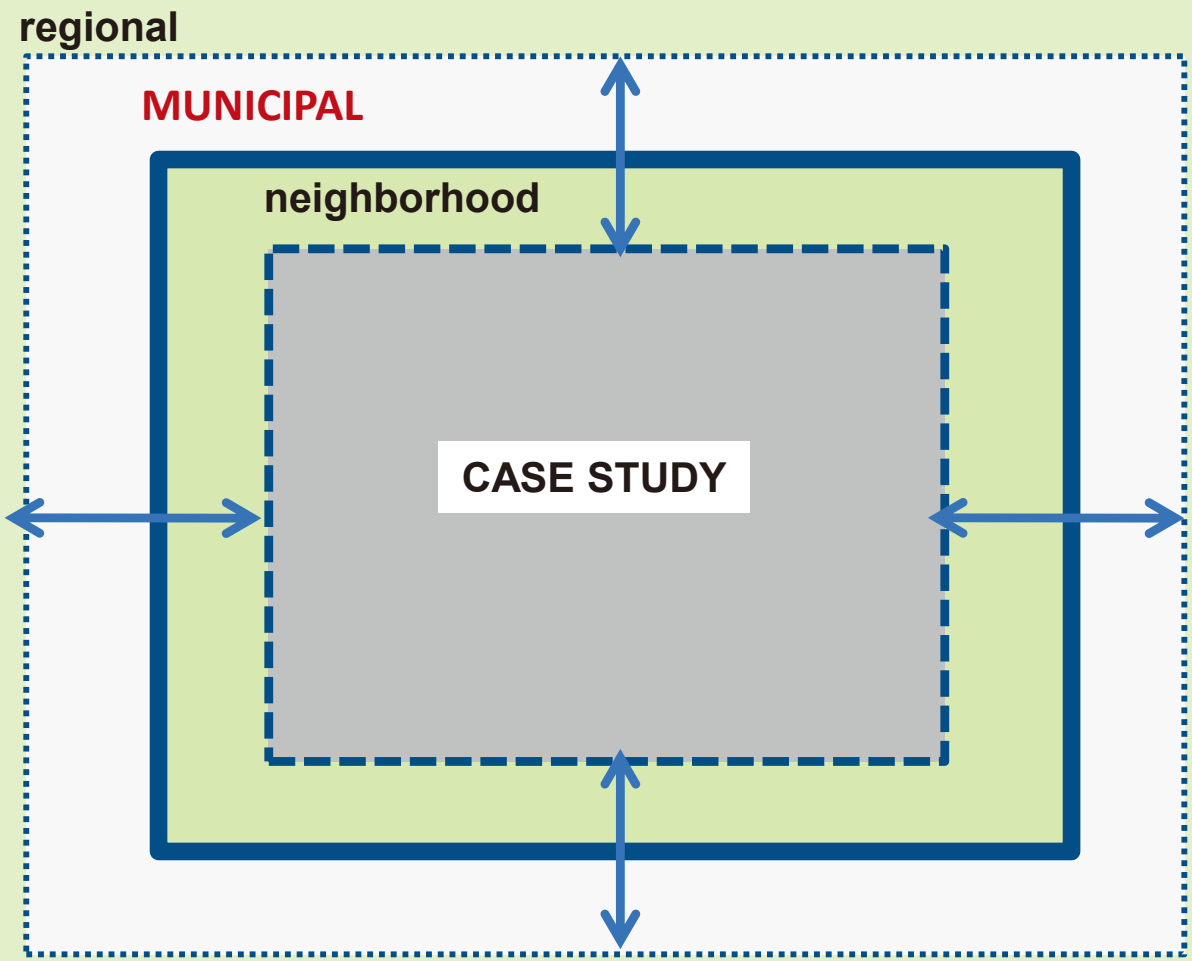
IDENTIFY

- relevant indicators;
- interrelationships between factors contributing to CO_2 reduction;
- CO_2 emission reduction strategies;
- baselines for energy consumption;
- uses of energy efficient and renewable energy technologies.

VERIFY

- effectiveness of tools and methods;
- reductions of energy consumption and CO_2 emissions;
- social impact ;
- improved indoor environmental qualities (IEQ);
- investment costs.

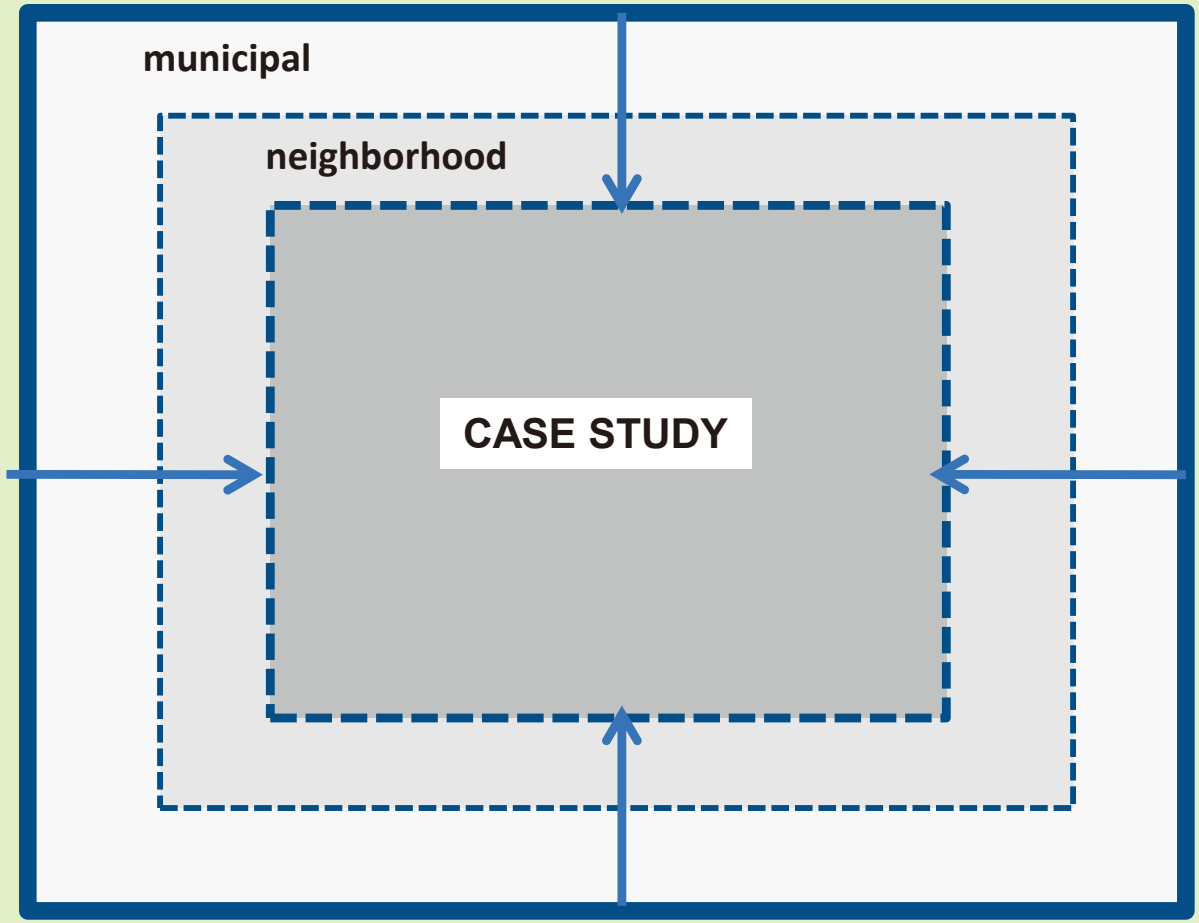
CASE STUDIES



In order to address the multiple dimensions involved the problem of CO_2 emission reduction, the tools and methods developed in this project will integrate the neighbourhood, municipal and regional scales.

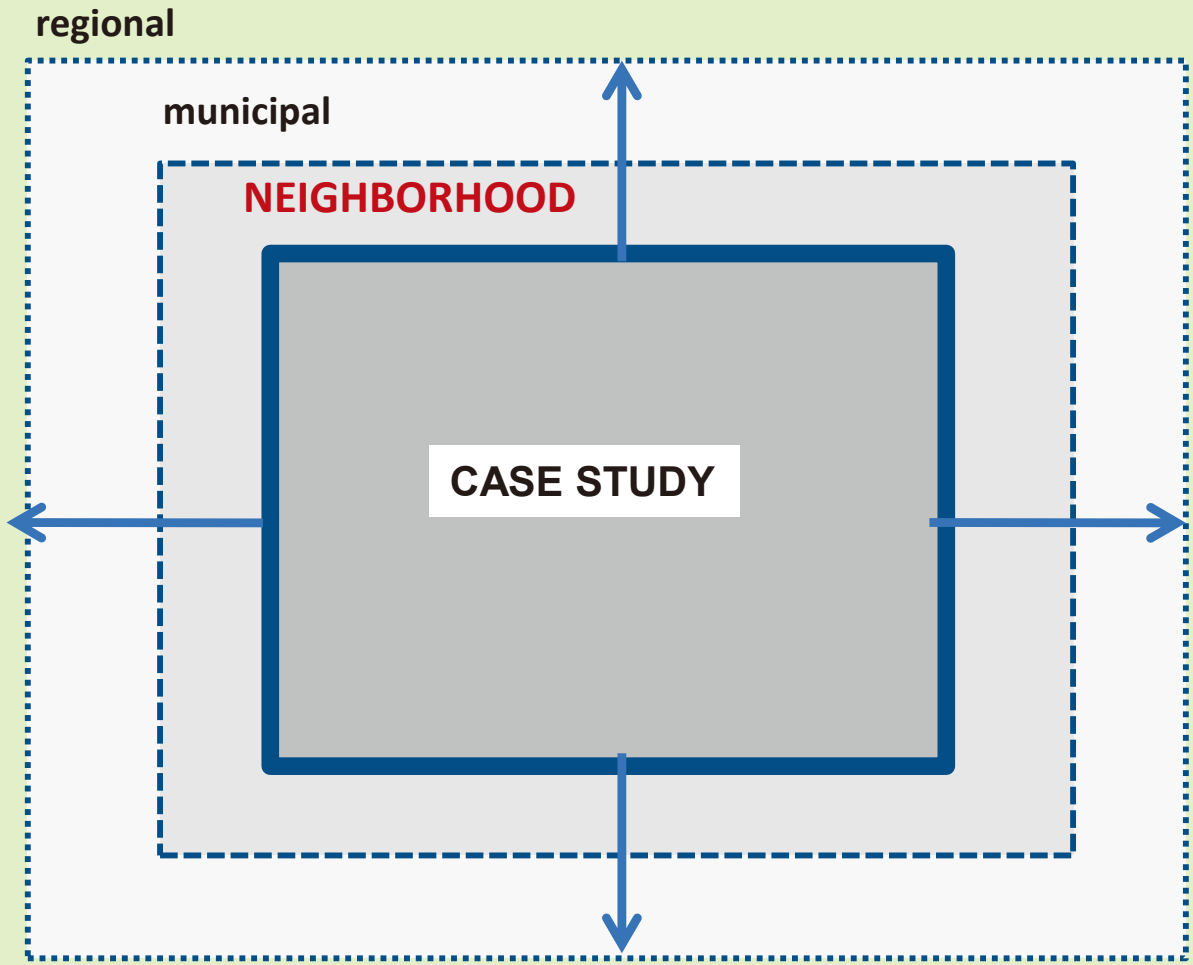
CASE STUDIES

REGIONAL



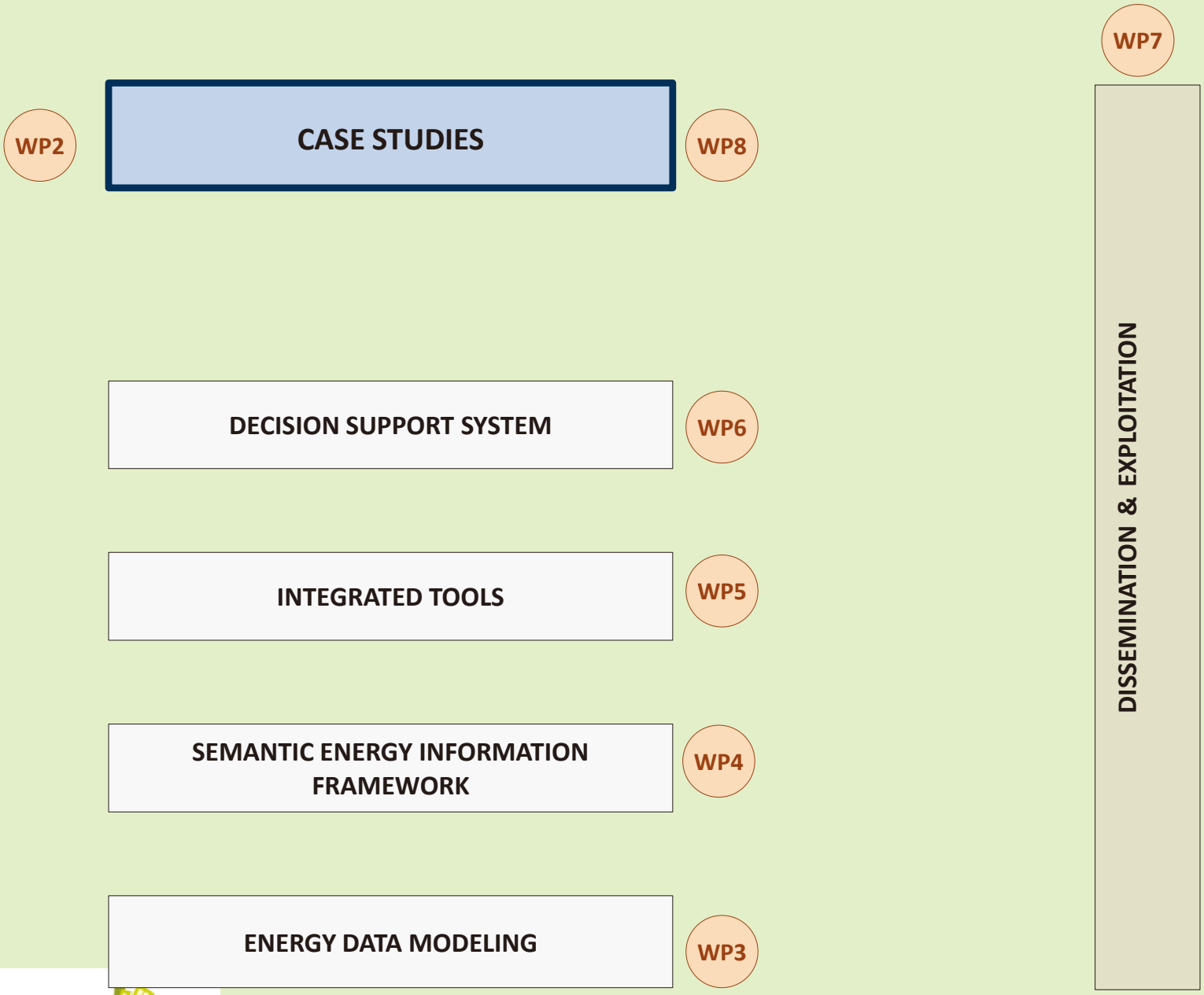
The interrelationships of emission reduction measures applicable at the three scales will be explored in each of the case studies.

CASE STUDIES



From the implementation of the tools and methods in each a set of procedures will be derived which can be extended to other cases, in other locations.

STRUCTURE OF WORK PLAN



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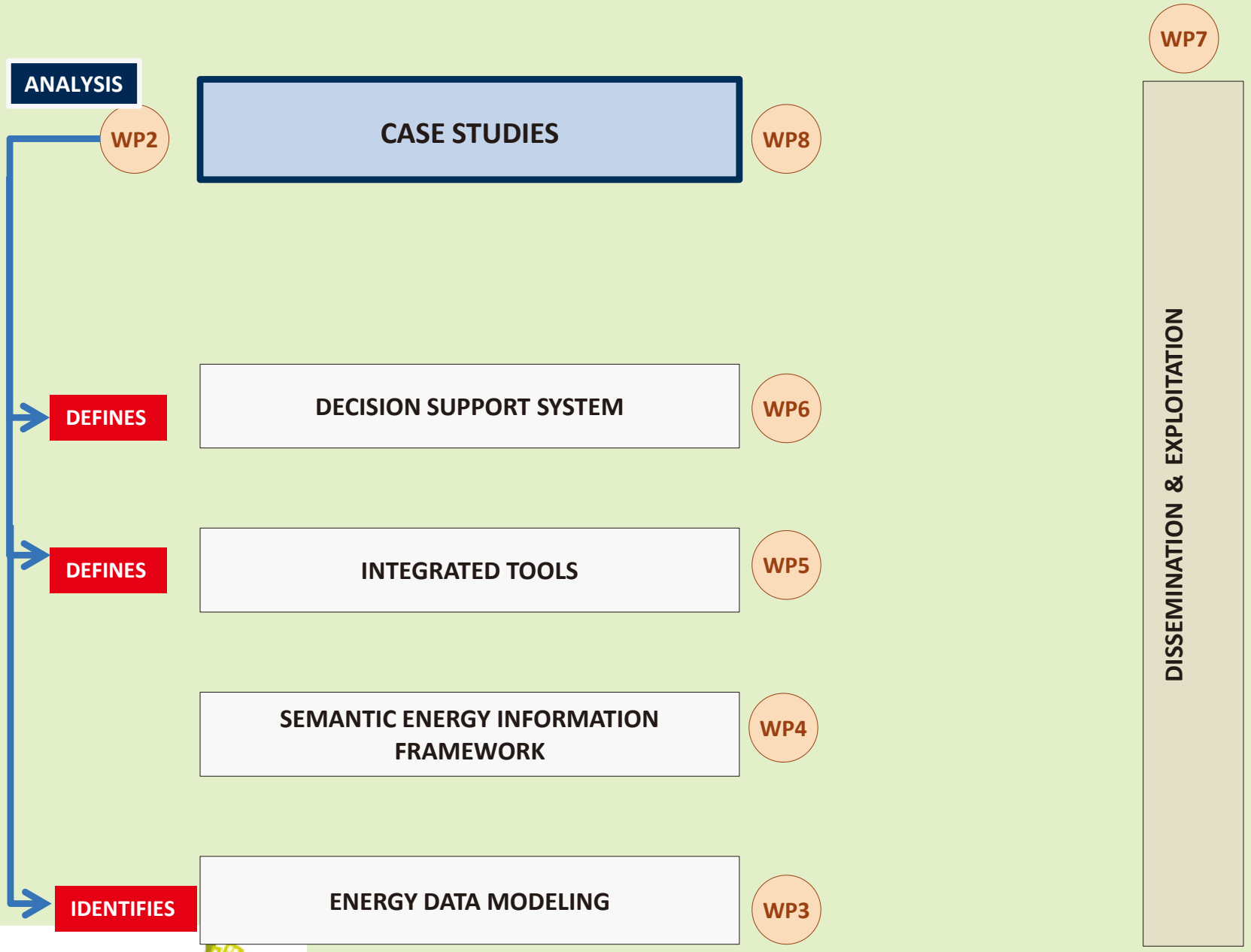

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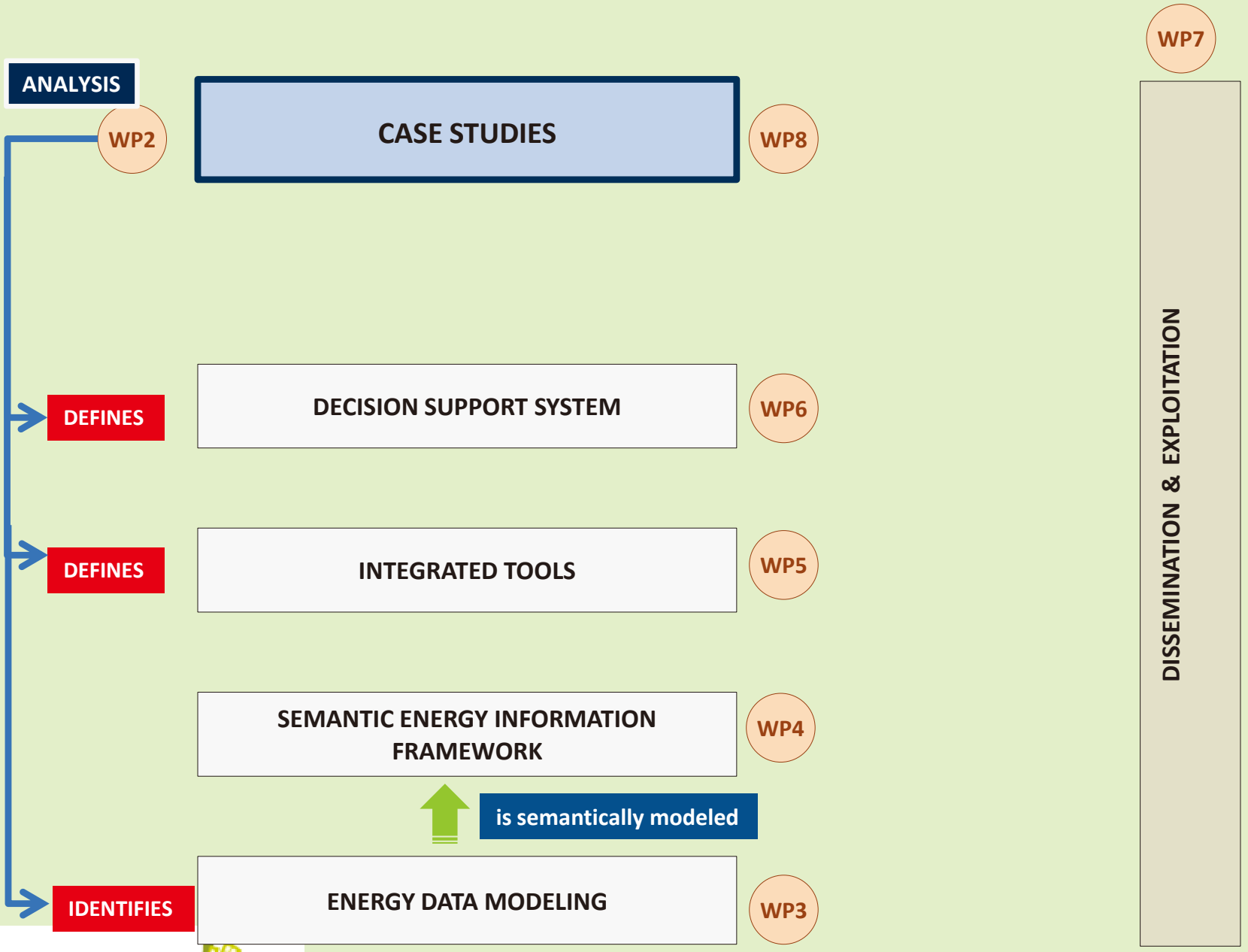

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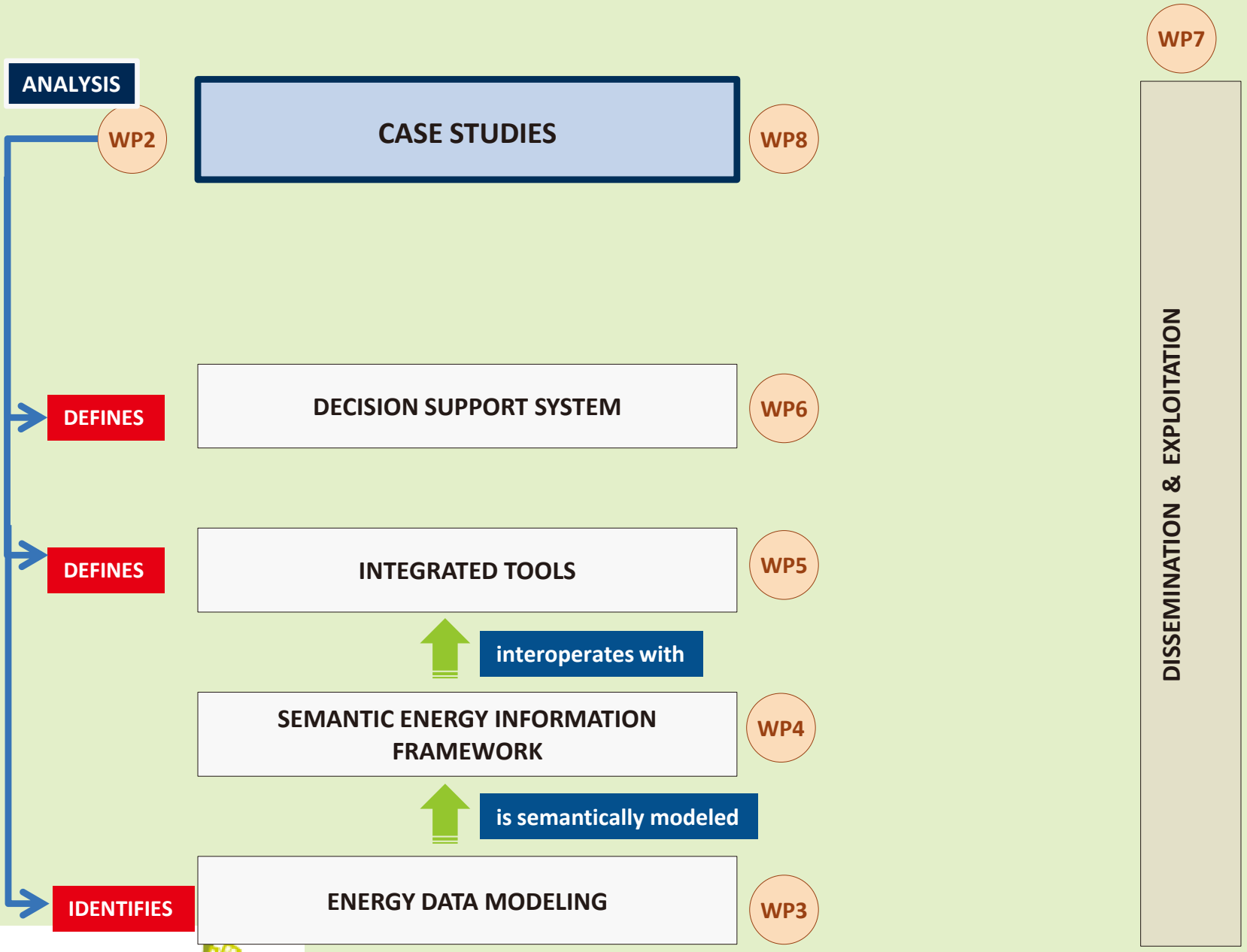

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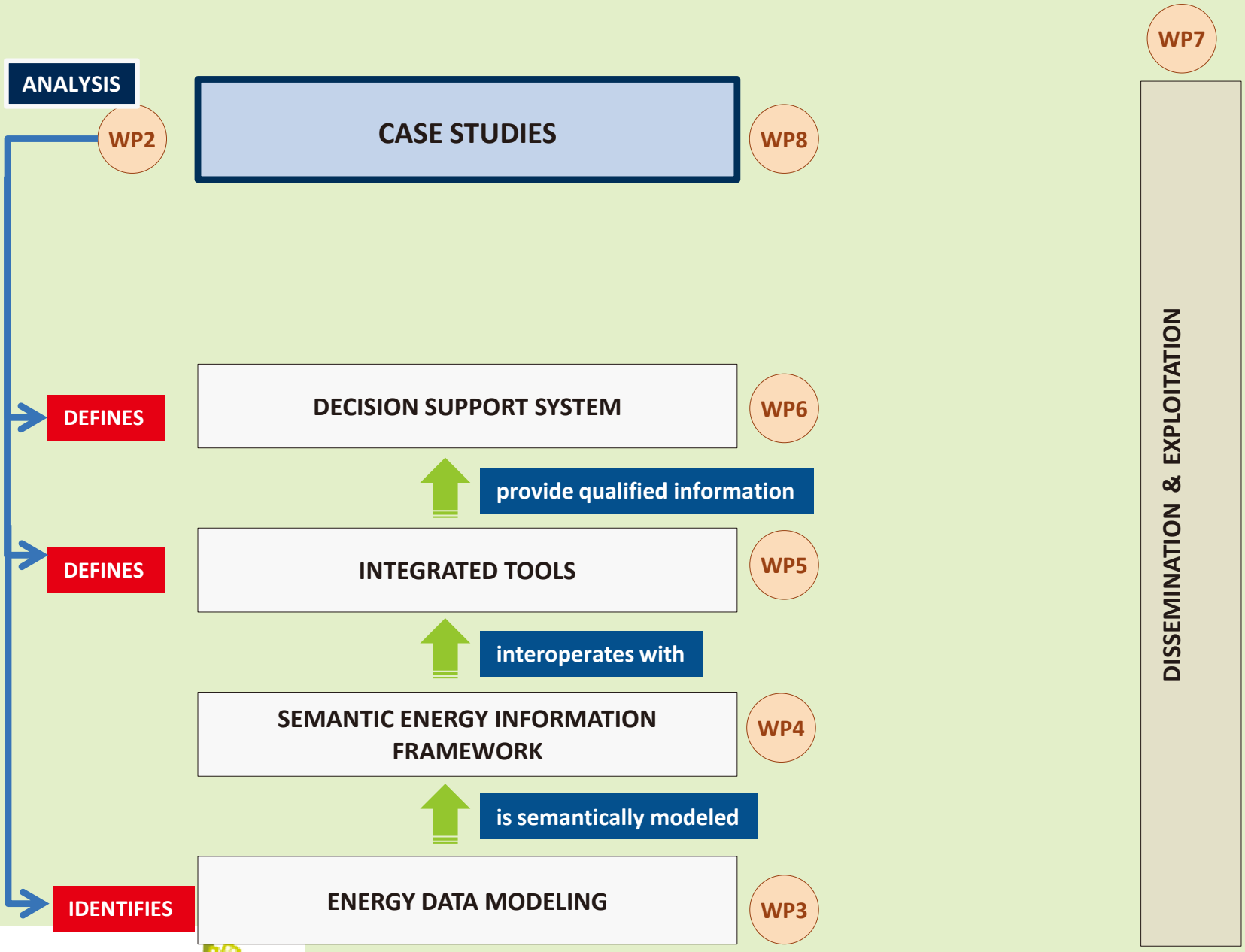

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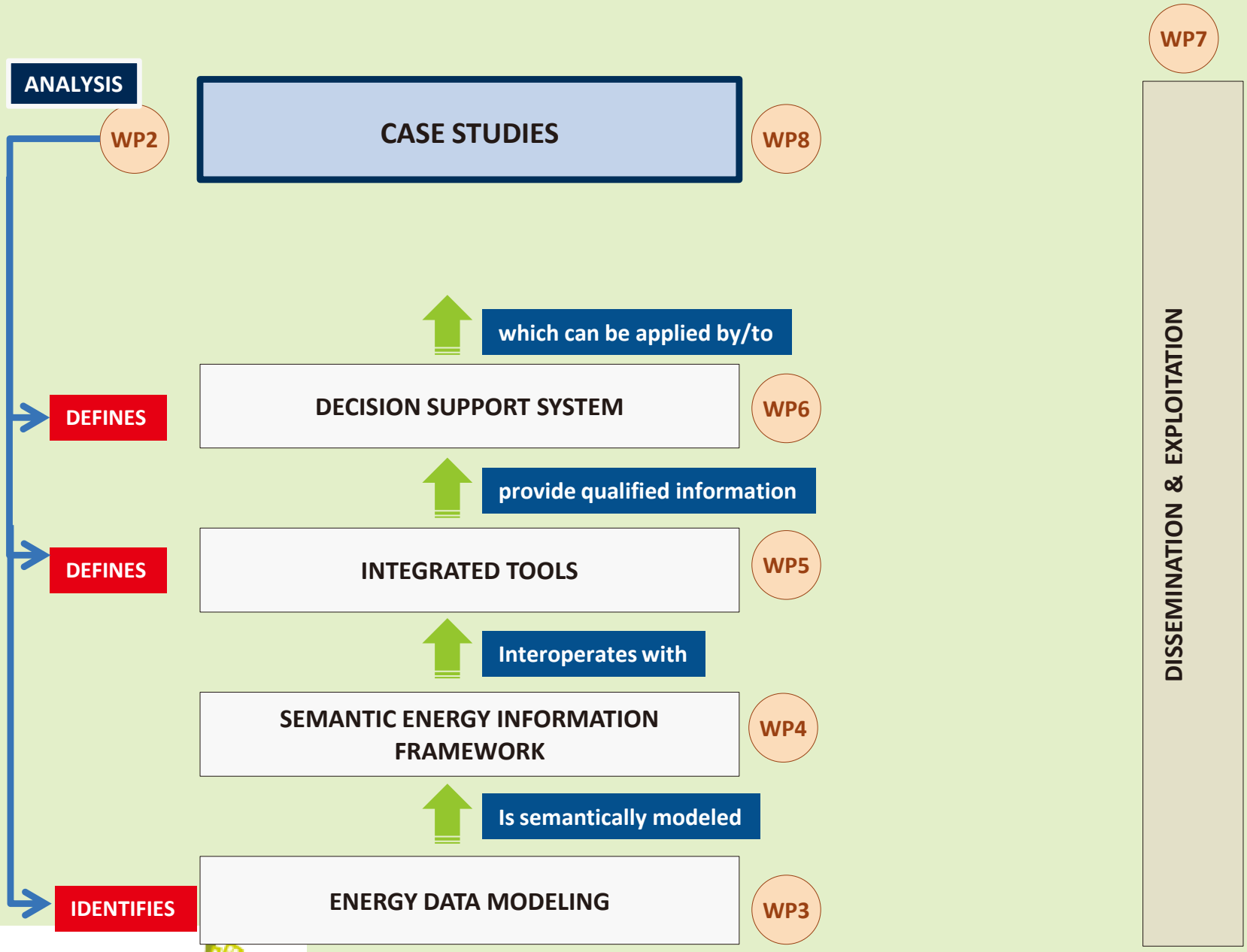

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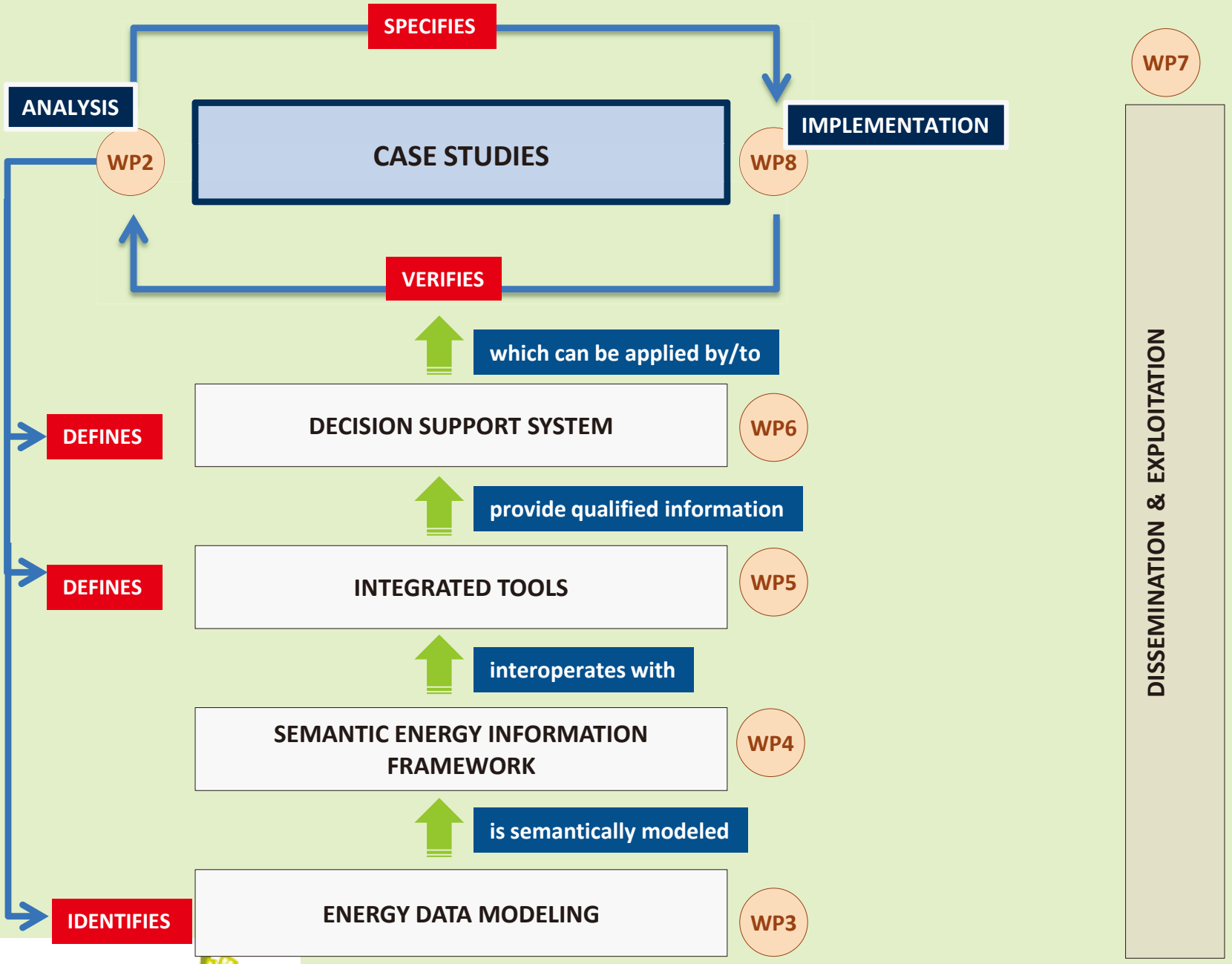

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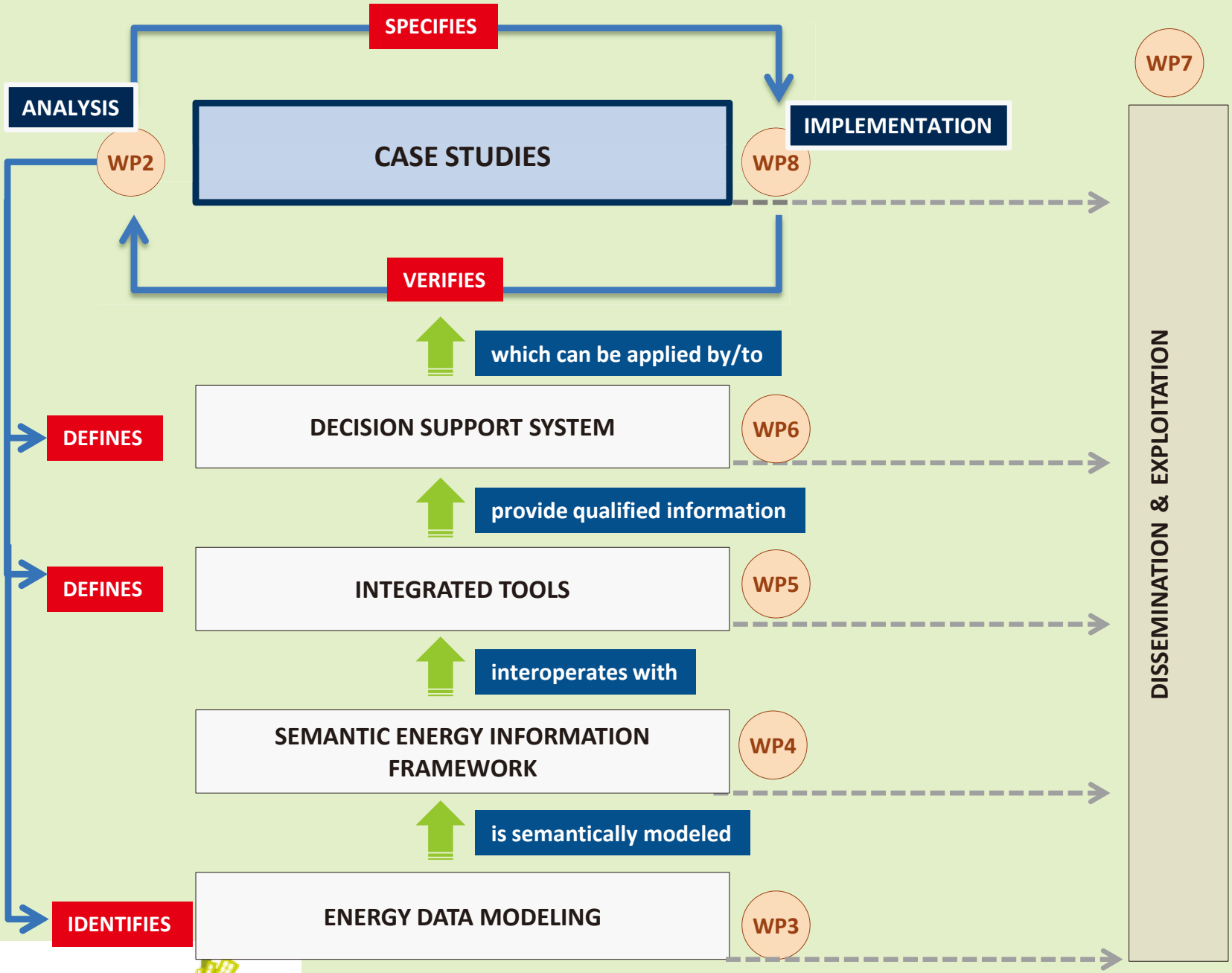

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EXPECTED OUTPUTS AND IMPACTS

The project will deliver **methods and tools:**

- to measure the **energy** performance based on existing and recognized data sources;
- to provide a better **understanding** of where these emissions are concentrated;
- to improve the **quality of the analysis** of CO_2 production factors;
- to establish **baselines** to apply to other scenarios to reduce CO_2 and reduce energy consumption .

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EXPECTED OUTPUTS AND IMPACTS

For more information, please contact:
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