GeoSmartCity

open geo-data for innovative services and user applications towards Smart Cities

CIP ICT-PSP Project n. 621150

Start date 01-03-2014, duration 36 months

Open geo-data for innovative services and user applications towards Smart Cities

GeoSmartCity implements a platform to share and public geographical open data coming from different sources, such as Public Administrations, Multi-utilities, Companies and Crowd-sourcing.

The platform includes specialized web services to integrate public geographical data with other geo-refenced data (public or private) useful for the smart management of urban infrastructures and public services in the context of the **Smart City** initiative and the **Digital Agenda** for Europe.

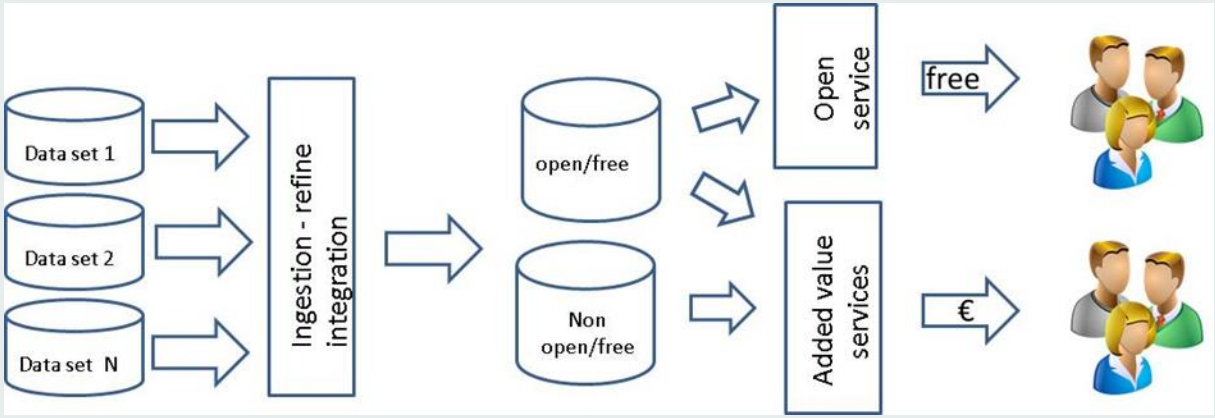
Partnership

Objectives

- Support Cities to 'open' their data to professionals and citizens
- Establish a cross-platform, re-usable, able to publish open-(GI) data, in an urban context, but with a European dimension
- Provision of tools and facilities to integrate GI data/info with open data
- Framework and services to integrate proprietary/restricted data with open (GI) data of the City

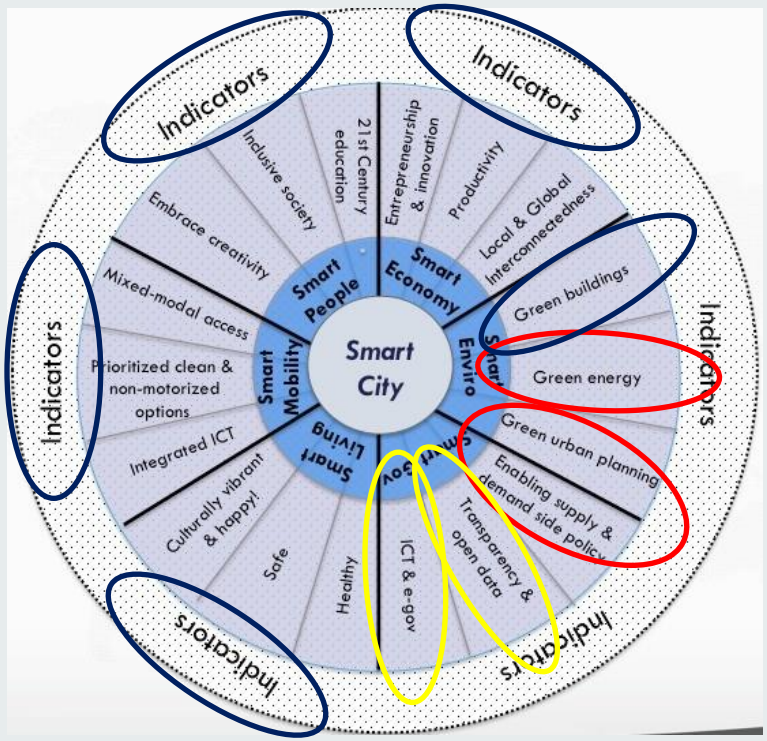
Objectives vs Exploitation

- Open infrastructure to build new business model for PAs and SMEs
- PPP (Public Private Partnerships): collaborative management of Open(GI) data
- Integration of restricted data in a secure way



Objectives vs Exploitation

- Open infrastructure extandable to different SmartCity contexts



- Two application scenarios:

✓Green Energy (5 pilot cases)
✓ Underground (6 pilot cases)

ICT Objectives

- Harmonised environment to integrate different operational protocols and standards, based on existing infrastructures
- Re-use of specialized services based on open standards
- Integration of new base/specialized services
- Ingestion and data integration engine composed by:
  - Harmonised data storage (based on GI standard, open data format)
  - a set of ingestion and data relation services:
    - Ingestion toolkit of GI data (open/restricted)
    - Ingestion toolkit of not-GI data (open/restricted)
    - Refine and reconcile toolkit to link and interconnect data
    - Crowd-sourcing base services based on location services

Outcomes

1. ***GI Open Data Repository and Target Data Models***

   Open and proprietary datasets including geo-spatial information in an interoperable infrastructure based on open standards.

2. ***GeoSmartCity Hub***

   A cross-platform, re-usable and open hub able to publish open geographic information and to provide specialised services based on open standards services.

3. ***Innovative Services***

   Services platform to View, analyze, extract data from the GeoSmartCity OpenData Hub; Universal Discovery Services; BI and Geoprocessing service platform; Ingestion and data integration engine.

Outcomes

4. ***Green Energy Scenario***

   Operative and re-usable pilot cases to facilitate diffusion and management of renewable energy within cities.

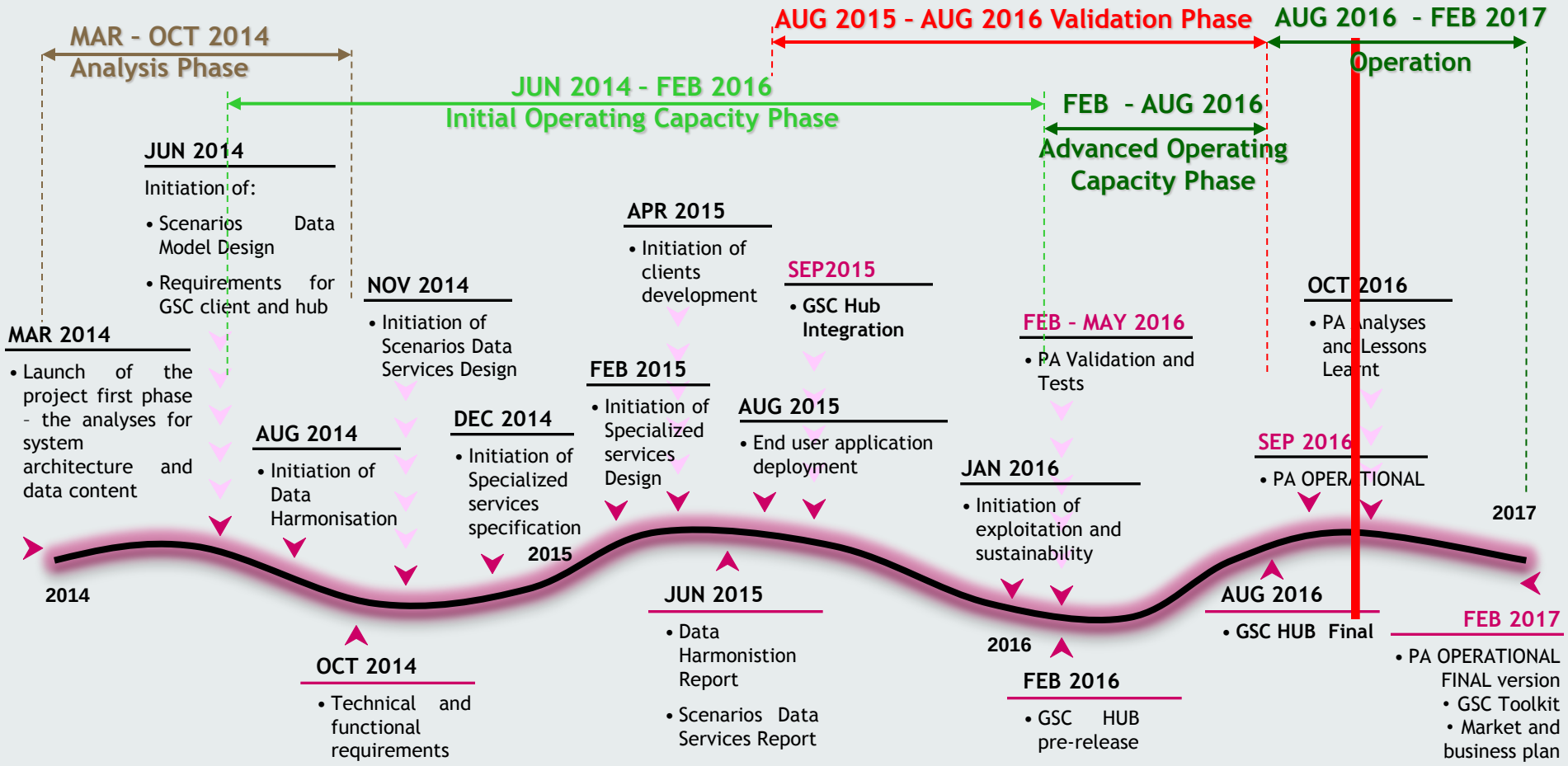
5. ***Underground Scenario***

   Operative and re-usable pilot cases to support integrated management of underground utilities infrastructures

6. ***GeoSmartCity Training Framework***

   Designed in order to make available existing knowledge and transfer the outcomes of the project towards the target groups of users. The Training Framework complements and support dissemination and exploitation, fostering Capacity Building

Road Map


MAR - OCT 2014
Analysis Phase
JUN 2014 - FEB 2016
Initial Operating Capacity Phase
AUG 2015 - AUG 2016 Validation Phase
AUG 2016 - FEB 2017
Operation
FEB - AUG 2016
Advanced Operating Capacity Phase
JUN 2014
Initiation of:
• Scenarios Data Model Design
• Requirements for GSC client and hub
MAR 2014
• Launch of the project first phase - the analyses for system architecture and data content
AUG 2014
• Initiation of Data Harmonisation
NOV 2014
• Initiation of Scenarios Data Services Design
DEC 2014
• Initiation of Specialized services specification
APR 2015
• Initiation of clients development
FEB 2015
• Initiation of Specialized services Design
SEP2015
• GSC Hub Integration
AUG 2015
• End user application deployment
FEB - MAY 2016
• PA Validation and Tests
JAN 2016
• Initiation of exploitation and sustainability
OCT 2016
• PA Analyses and Lessons Learnt
SEP 2016
• PA OPERATIONAL
2014
2015
2016
2017
OCT 2014
• Technical and functional requirements
JUN 2015
• Data Harmonistion Report
• Scenarios Data Services Report
FEB 2016
• GSC HUB pre-release
AUG 2016
• GSC HUB Final
FEB 2017
• PA OPERATIONAL FINAL version
• GSC Toolkit
• Market and business plan

City Pilots and Scenarios

Turku

Flanders Region

South Moravian Region

Comarca of Pamplona

Ruda Slaska (Katowice area)

Reggio nell'Emilia

Girona

Genova

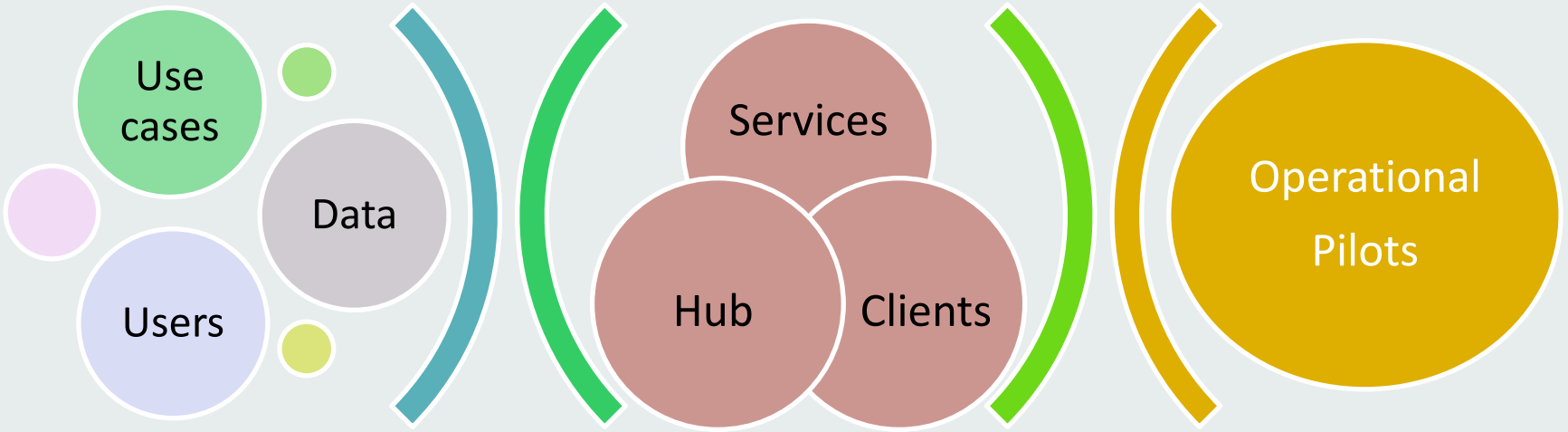
Maroussi

Oeiras

Oeiras

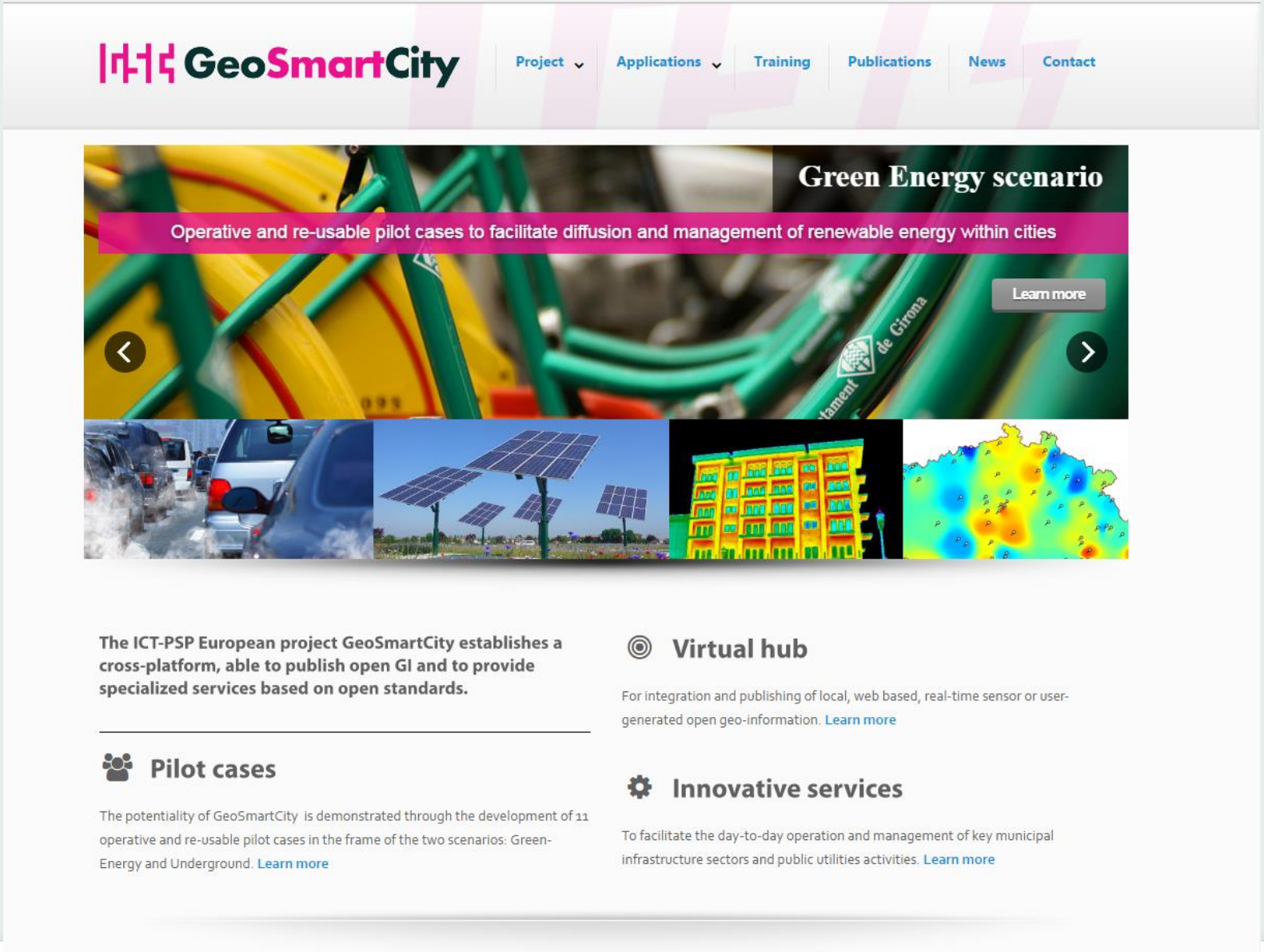
GEOSMARTCITY SCENARIOS

PROJECT PHASES



ANALYSIS	DESIGN	IMPLEMENTATION
Use case analysis and description	Technical specifications	Real Deployment
Requirements analysis and description		

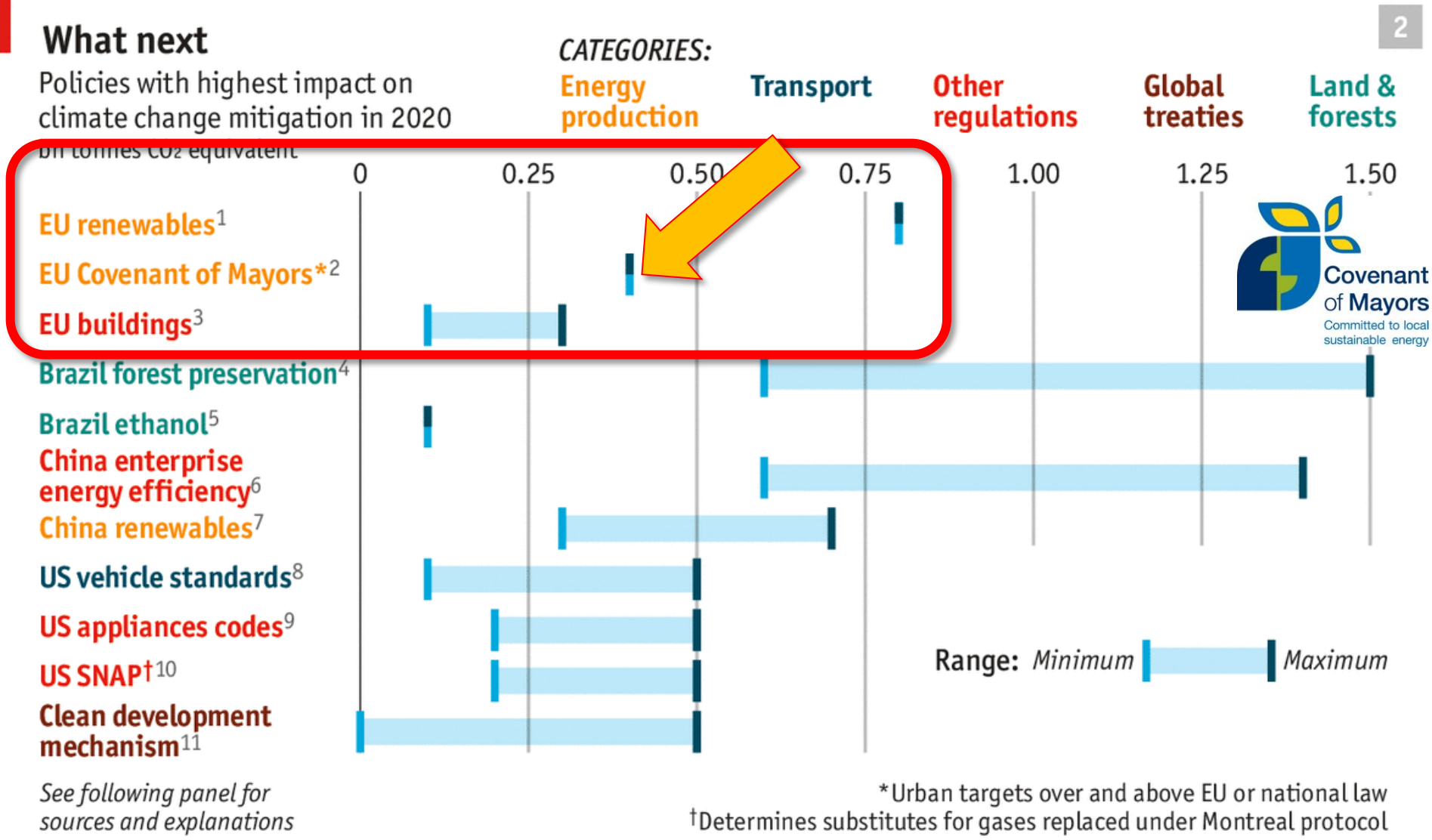
GREEN ENERGY SCENARIO



Commonalities

- In the case of “Green Energy” scenario the fil rouge is represented by the Covenant of Mayor (CoM)
- CoM may cover all use cases and requirements expressed by each pilot on
  - energy performance of buildings (municipal, residential, …)
  - transportation

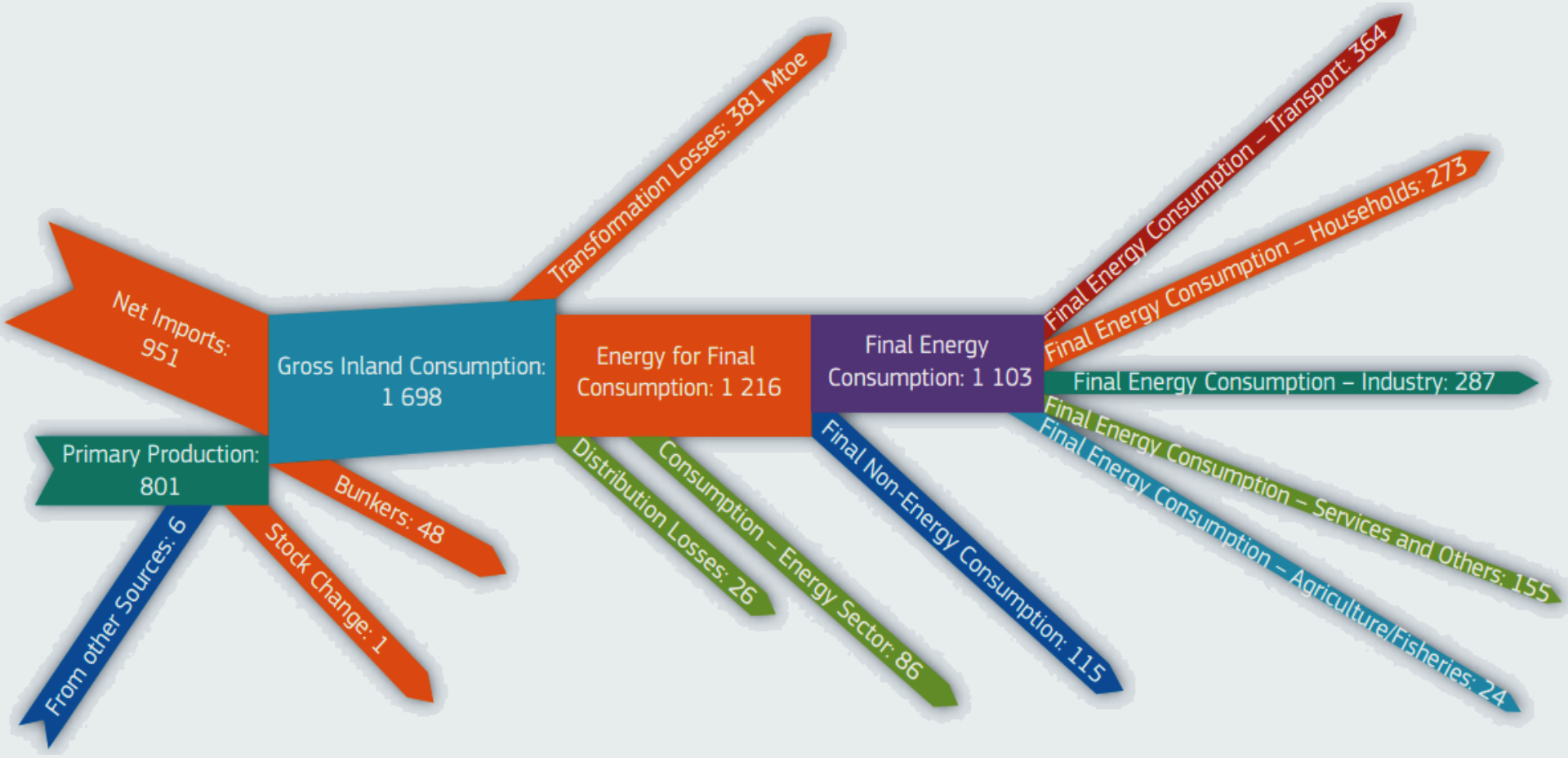
http://www.eumayors.eu/IMG/pdf/seap_guidelines_en.pdf



http://www.economist.com/news/briefing/21618680-our-guide-actions-have-done-most-slow-global-warming-deepest-cuts

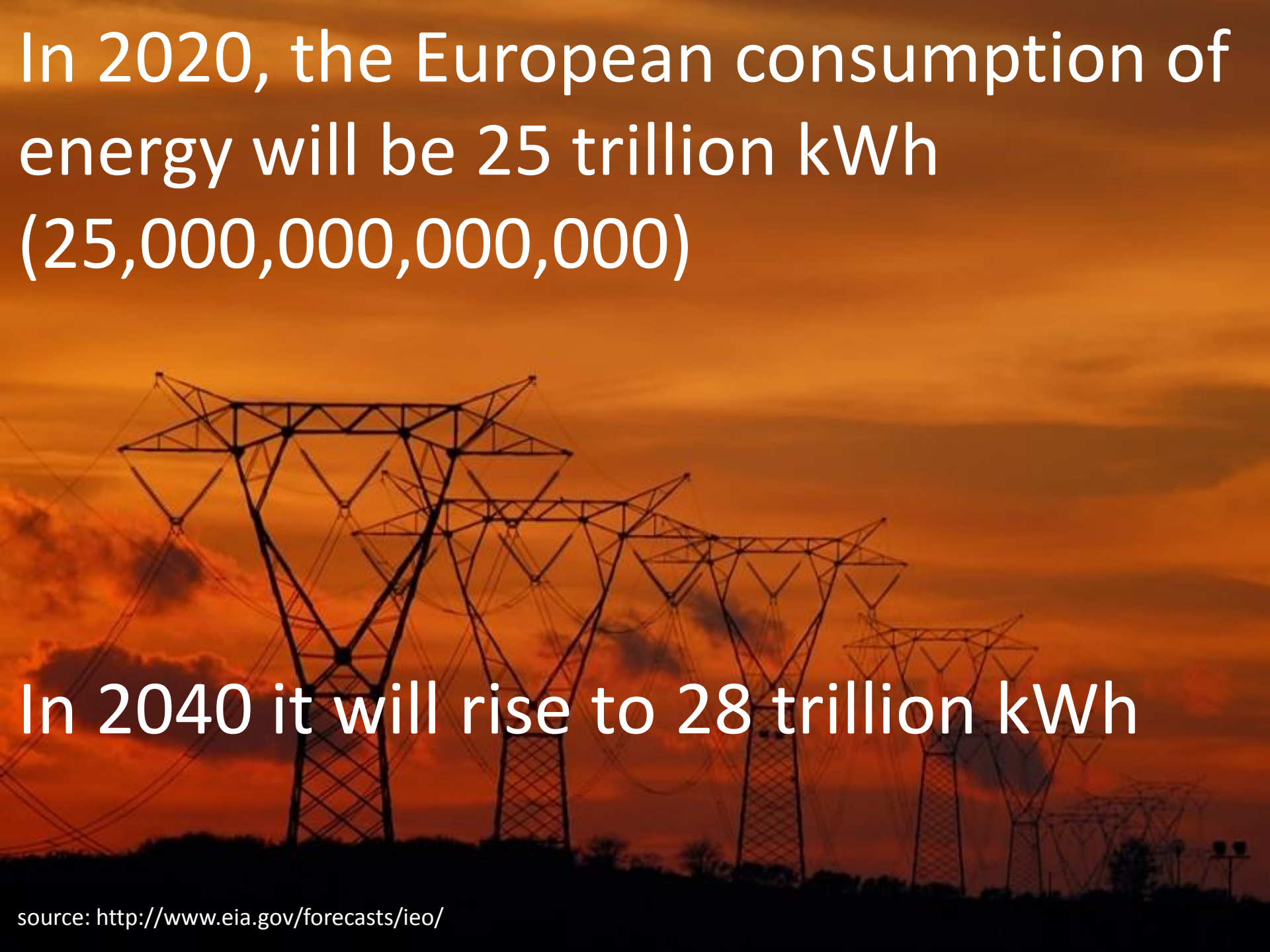
Few (big) numbers
with focus on “buildings”

Europe 2011 - Energy Flow (MTOE)



source: http://ec.europa.eu/energy/publications/doc/2013_pocketbook.pdf

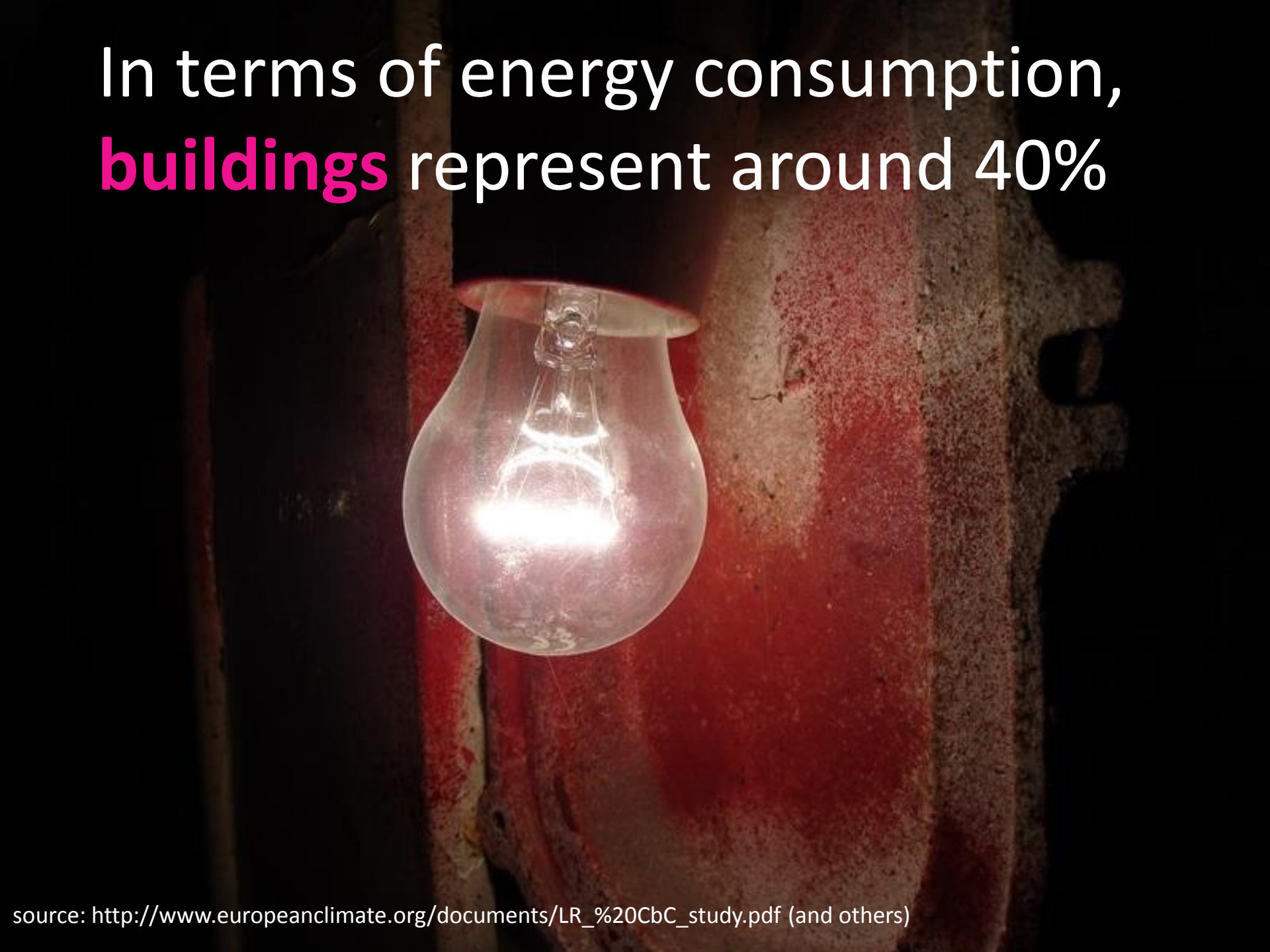
In 2020, the European consumption of energy will be 25 trillion kWh (25,000,000,000,000)



In 2040 it will rise to 28 trillion kWh

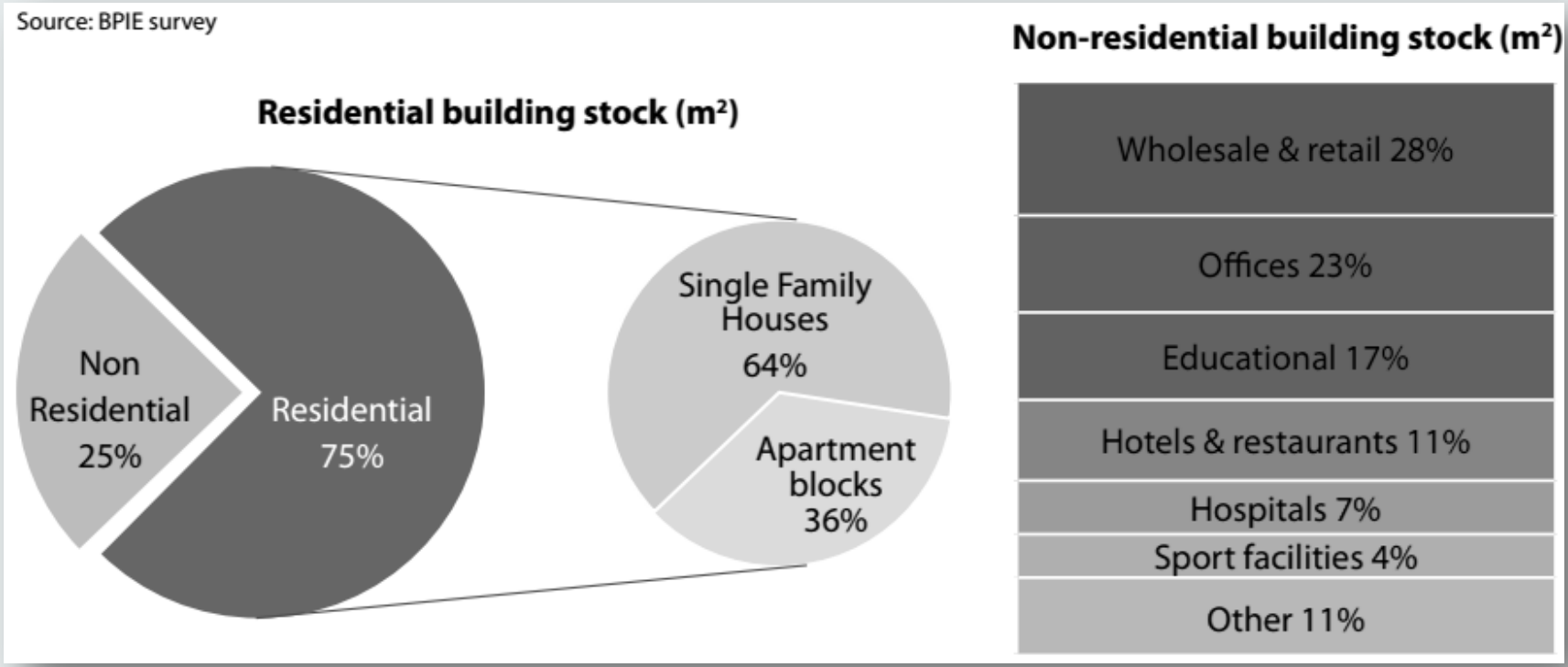
source: http://www.eia.gov/forecasts/ieo/

In terms of energy consumption, **buildings** represent around 40%



source: http://www.europeanclimate.org/documents/LR_%20CbC_study.pdf (and others)

In EU, the gross floor space could be concentrated in a land area equivalent to that of **Belgium** (30,528 km2).

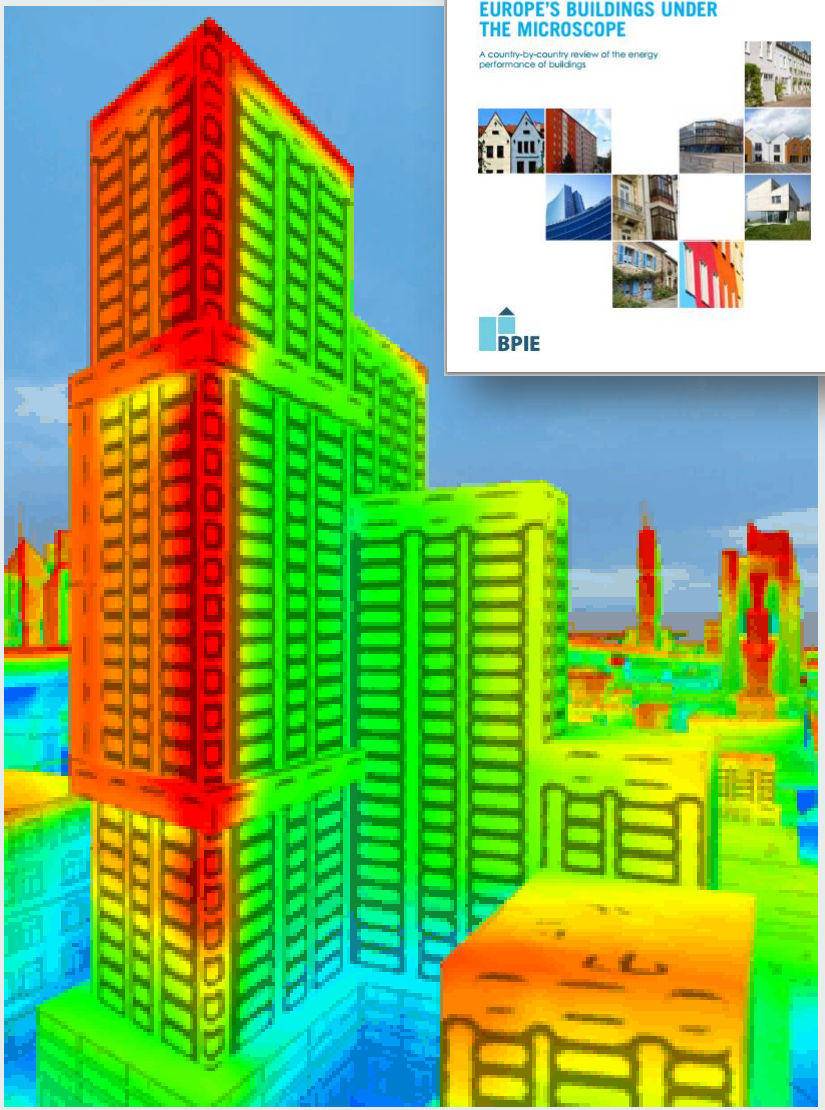


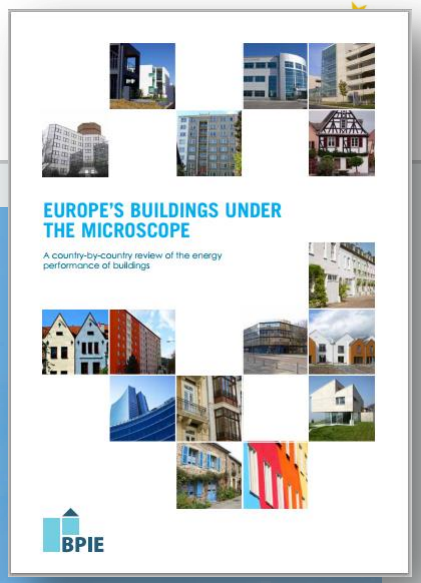
source: http://www.europeanclimate.org/documents/LR_%20CbC_study.pdf

European **households** are responsible for **68%** of the total final energy use in buildings, for:

- heating (**70%**)
- cooling
- hot water
- cooking
- appliances

The most used fuel is gas.





source: http://www.europeanclimate.org/documents/LR_%20CbC_study.pdf

PILOTS GREEN ENERGY

Applications Showcase

11 Smart City operative applications demonstrating the added value services of the Hub.

Apps Showcase

GeoSmartCity Showcase

Project website | Contact Us

Green Energy applications

Reggio nell'Emilia | Italy

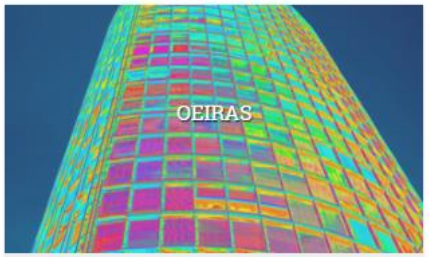
Specialized services for integration and harmonization of buildings energy consumption data.

View details

Maroussi | Greece

Collection of geo referenced information about building data, green energy production and energy consumption.

View details



Oeiras | Portugal

Specialided services for energy performance, emissions estimation and Solar potential calculation.

View details

Turku | Finland

Supporting the reduction of traffic emissions trough "green" routing and parking applications.

View details

Girona | Spain

Supporting and promoting bicicle mobility trough open data provission and routing functionalities.

View details

- 5 pilot cities involved in this scenario
  - Reggio Emilia (Italy)
  - Maroussi (Greece)
  - Oeiras (Portugal)
  - Turku (Finland)
  - Girona (Spain)

- 13 Use Cases collected

- 61 requirements (functional, non-functional, generic)

Data will mainly regard:

- Buildings (municipal, residential, …)
- Transport (focus on bike)

Buildings and transport represent GHG emission sources.

All five pilot cities are indeed signatories of the **Covenant of Mayors** and need to:

- monitor GHG emission sources
- provide information to stakeholders

Reggio Emilia (Italy)

Use cases

- Publication of **energy performance and consumption** of municipal buildings
- Publication of energy performance of other buildings

General objectives

- Integrate geodata and energy data for strategic purposes
- Provide integrated open geodata

Main requirements

- Estimate energy performance and CO2 emissions
- Energy maps and reports, interoperable access to data

Maroussi (Greece)

Use cases

- Data collection via field survey and crowdsourcing
- Energy map creation
- Data publication

General objectives

- Enable citizens and SMEs to make valuable comments and enhance their energy consumption behavior

Main requirements

- Mobile app for editing buildings' properties
- Searching capabilities for buildings
- Provide open geodata through the hub

Oeiras (Portugal)

Use cases

- Urban sustainable planning tool
- Zero-balance calculation
- Calculation of energy performance of buildings

General objectives

- Monitor energy consumption in public buildings
- Achieve a balance between various urban areas

Main requirements

- Calculate solar potential and electric balance
- Reports, statistics

Turku (Finland)

Use cases

- Selecting green route
- Green driving
- Green parking

General objectives

- Shift from private to public transportation in commuter traffic
- Acquire real-life information that can be utilized in city planning and decision making

Main requirements

- Bike routing, bus timetables, paths for commuters
- Estimation of fuel consumption, collect stats

Girona (Spain)

Use cases

- "I want to ride my bicycle, I want to ride it where I like"
- Find healthy bike route

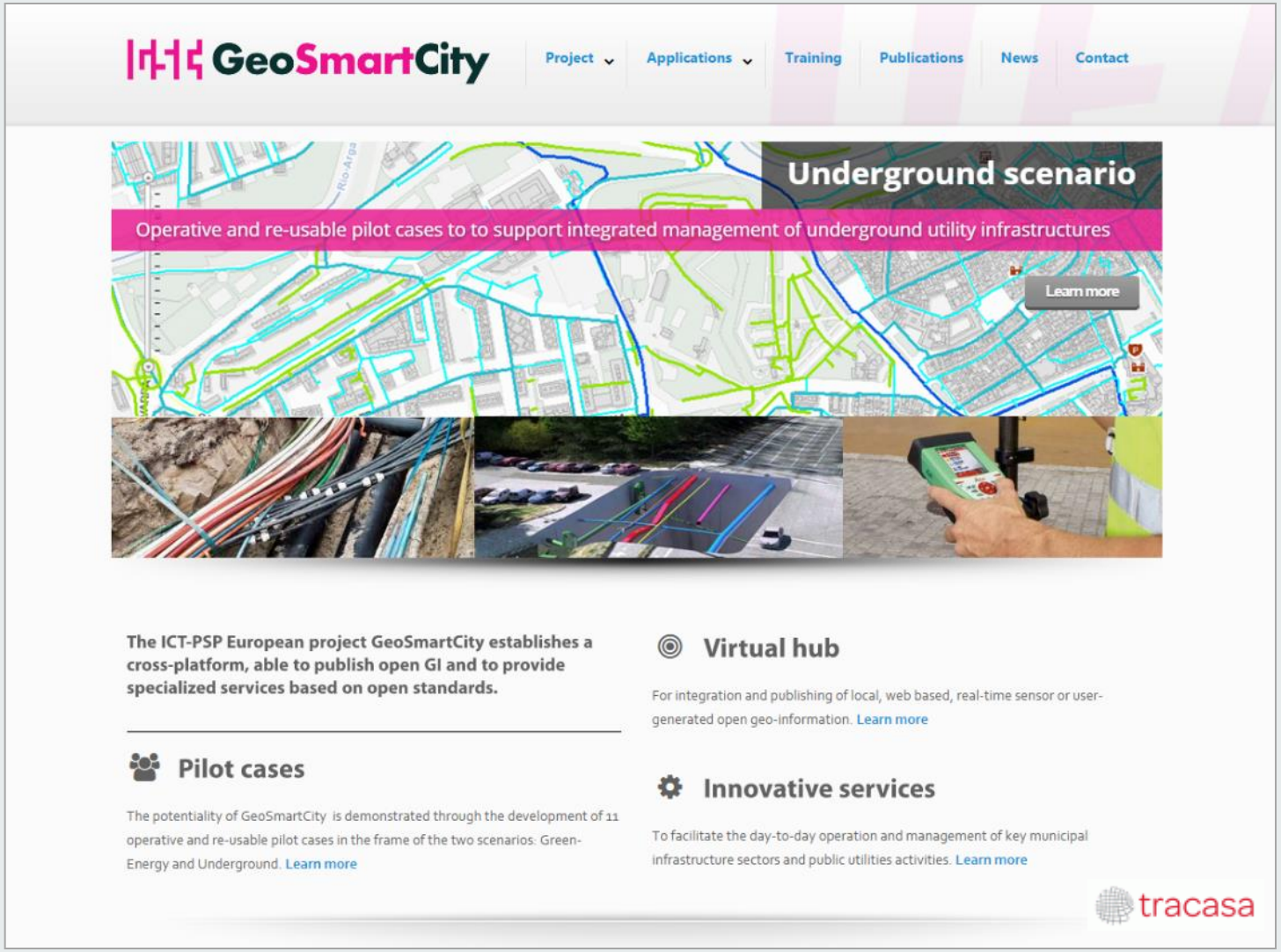
General objectives

- Encourage alternative/light transportation
- Involve city users and stakeholders in data integration

Main requirements

- Provide updates to OpenStreetMap
- Estimate pollution, calculate bike routing

Underground Scenario



Underground Context

- Different infrastructure under the same area
- Unconnected information for the management of assets and systems (damages during maintenance activities)
- Environmental ← impact → infrastructure
- Safety and security

UNDERGROUND SCENARIO

Status

- 6 pilot sites in EU
- 12 Use cases
- 61 User/System Requirements

Commonalities

- The improvement of the efficiency of the underground network management (mainly in terms of integration of resources from different actors)
- The citizen involvement (crowdsourcing mobile apps)

PILOTS UNDERGROUND

Applications Showcase

11 Smart City operative applications demonstrating the added value services of the Hub.

Apps Showcase

GeoSmartCity Showcase

Project website | Contact Us

Underground Management applications

Comarca de Pamplona | Spain

Improving GIS existing platform with real-time information provided by smart sensors through a SCADA system.

View details

Genova | Italy

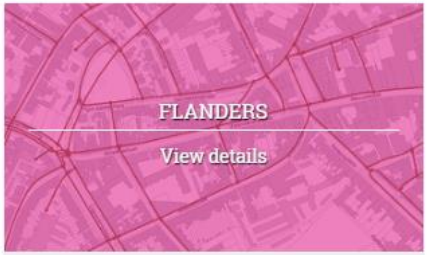
Integrated management of the utility networks and use of mobile client for data management and field works.

View details

Oeiras | Portugal

Implementing an event management platform (ruptures in water network) based on a mobile crowdsourcing app.

View details



Flanders region

Mobile application for the management of the sewage database and crowdsourcing tool.

View details

South Moravian region

Mobile crowdsourcing app to report a problems on the underground infrastructure and Augmented Reality.

View details

Ruda Śląska | Poland

integrated WebGIS platform giving the ability to verify/update basic information on the underground networks.

View details

Pamplona (Spain)

Use cases:

- Consulting real-time data of the water supply and sanitation systems in a GIS viewer.
- Check smart sensor values or incidents in networks

General Objectives:

- They want to improve the water and sewage GIS existing platform:
- Integrating **real-time information** provided by smart sensors through a SCADA system (a computer system for gathering and analyzing real time data)
- Consult a map with values from sensors or incidents from SCADA

Main requirements:

- The SCADA system should be linked to the GIS through standardized protocols
- An interface should enable the user to communicate with the SCADA system to consult the real-time data
- The platform should enable the user to generate thematic maps (geoprocessing)

Genova (Italy)

Use cases:

- Underground Cadastre
- Excavation procedure
- Field works
- Underground networks and environmental hazards

General Objectives:

- **Integrate different underground information** layers from different actors (mainly Municipality and Multi-utilities)
- Include **INSPIRE** compliant data in the city underground data management workflow (Harmonisation of gas, water and sewer datasets)
- Use of mobile client for data management
- Use of advanced visualization techniques such as **Augmented Reality**
- Use of a high precision positioning (**GNSS**) device integrated with mobile client for field works
- Intersection between Underground Network and **Environmental Hazard information**

Oeiras (Portugal)

Use cases:

- Underground Event Management

General Objectives:

- As in the case of the Oeiras Pilot in the Green Energy scenario, the Municipality wants to implement an event management platform.
- This platform will take shape in a mobile **crowdsourcing** app for characterization and location of **ruptures in water network**.
- The System shall serve as a Metadata and Open Data provider through Web Services (WMS, WCS, ...).

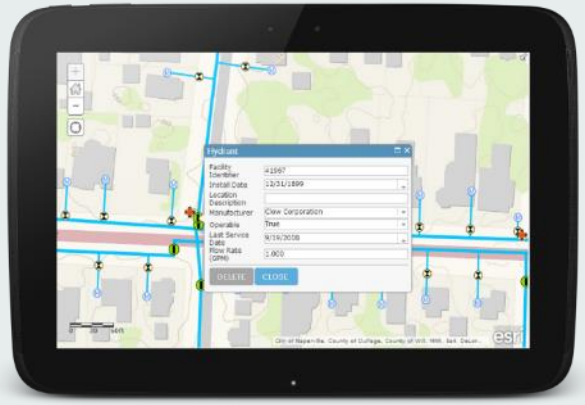
Main requirements:

- An authenticated user must approve the crowdsourcing inputs to appear on the map.
- The web client should ensure different authentication levels depending on user roles.
- Open data: All information must be available to be used by applications from other stakeholders.

Flanders Region (Belgium)

Use cases:

- Mobile application for the management of the sewage database
- Crowd-sourcing tool



General Objectives:

- Focus on the conformance of the Flanders sewer network data to **INSPIRE** specifications
- Manage sewage network from a **mobile/web client** application
- Integrate in the system a **crowdsourcing** component so the sewage database can be consulted by the public in order to report possible anomalies or remarks.

Main requirements:

- The application must give the opportunity to professionals to enter data, upload different files and to propose changes to geodata.
- The updates (by the users) are live but will only be implemented in the sewage database after validation.

South Moravian Region (CZ)

Use cases:

•Mobile application

General Objectives:

•Focus the provision or **volunteered geographic information** (VGI) trough a mobile app to report a problems on the public underground infrastructure.
•Use of mobile clients by municipalities and companies technicians (equipped with innovative visualization features such as **Augmented Reality**) to support the management and update of existing data on the field.

Main requirements:

•Take a picture, determine local position, user comment and send it to appropriate service.
•Read data from dedicated WFS and display them in AR environment.

Ruda Śląska (Poland)

Use cases:

•An integrated WebGIS platform giving the ability to verify/update basic information on the underground networks and to share the data in order to clarify the ownership issues.

General Objectives:

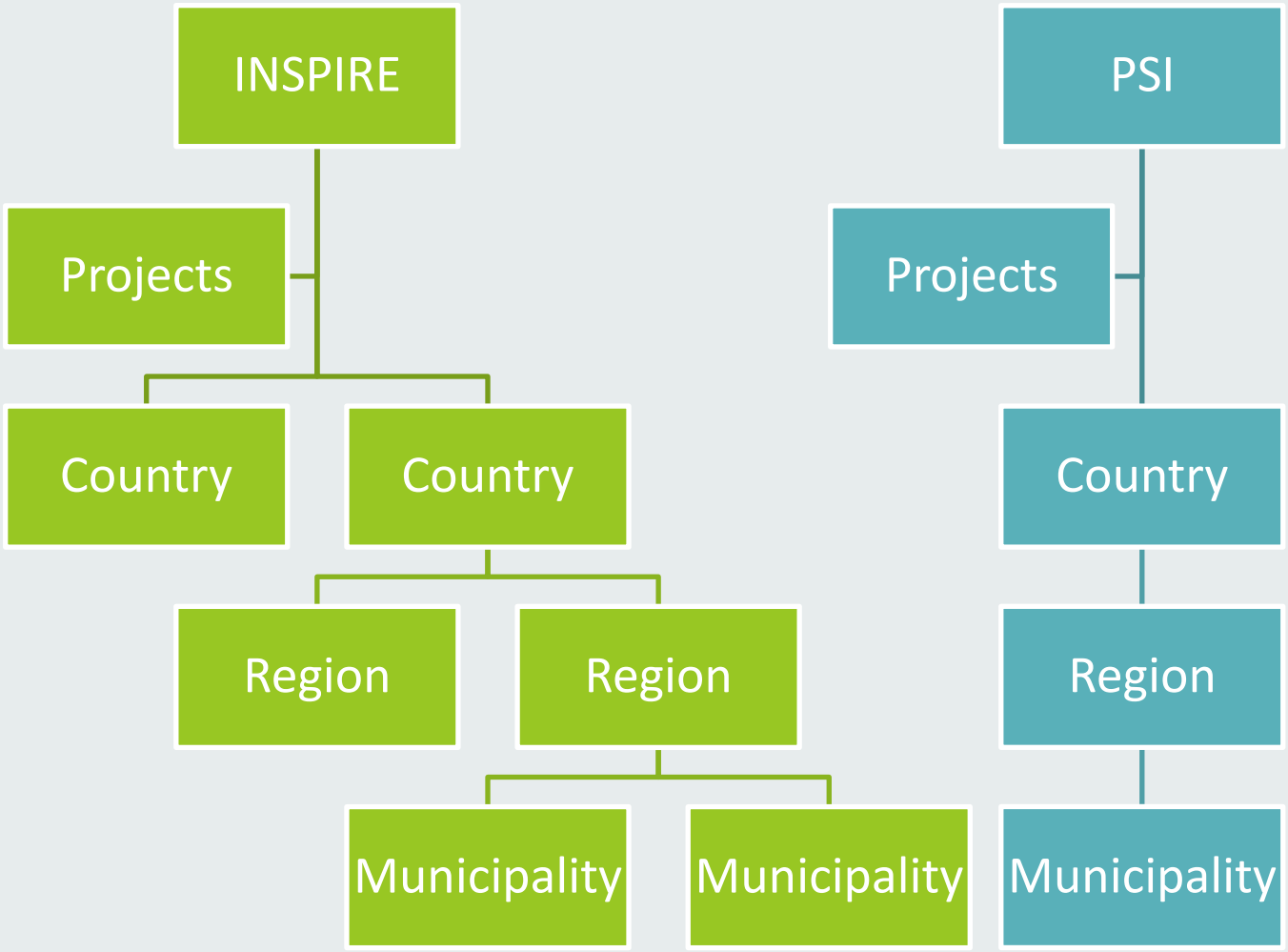
•Similar to the Genova case, this pilot also focuses on the **integration and harmonization of the underground network** data coming from the municipality and the Utility companies.
•Data and specialized services will be integrated in existing GIS platform supporting an integrated approach on the management and maintenance of the networks.

Main requirements:

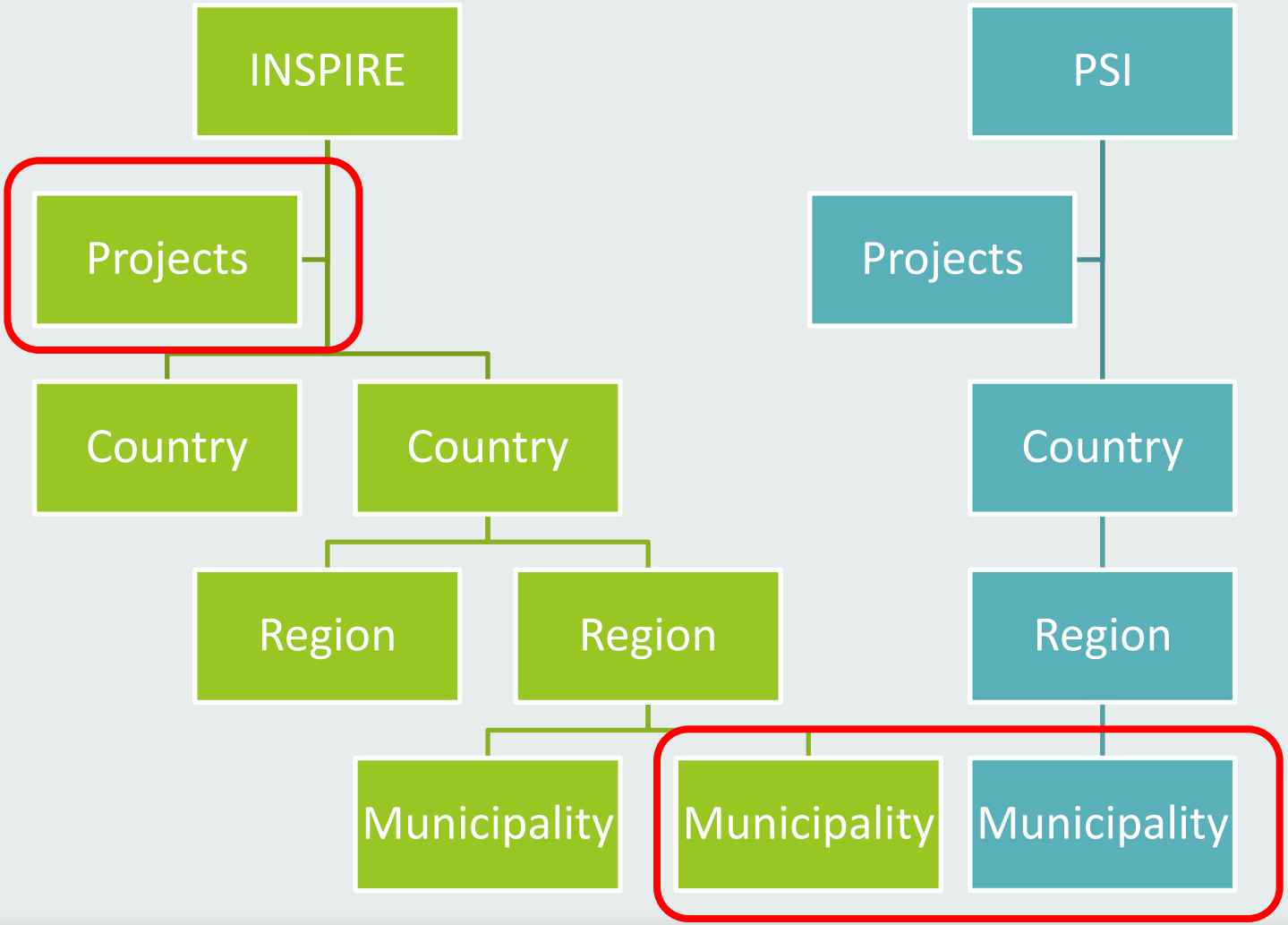
•Mobile and web clients
•Authenticated access to information and permission roles

The GeoSmartCity Hub

The challenge of European Data Infrastructures



The challenge of European Data Infrastructures



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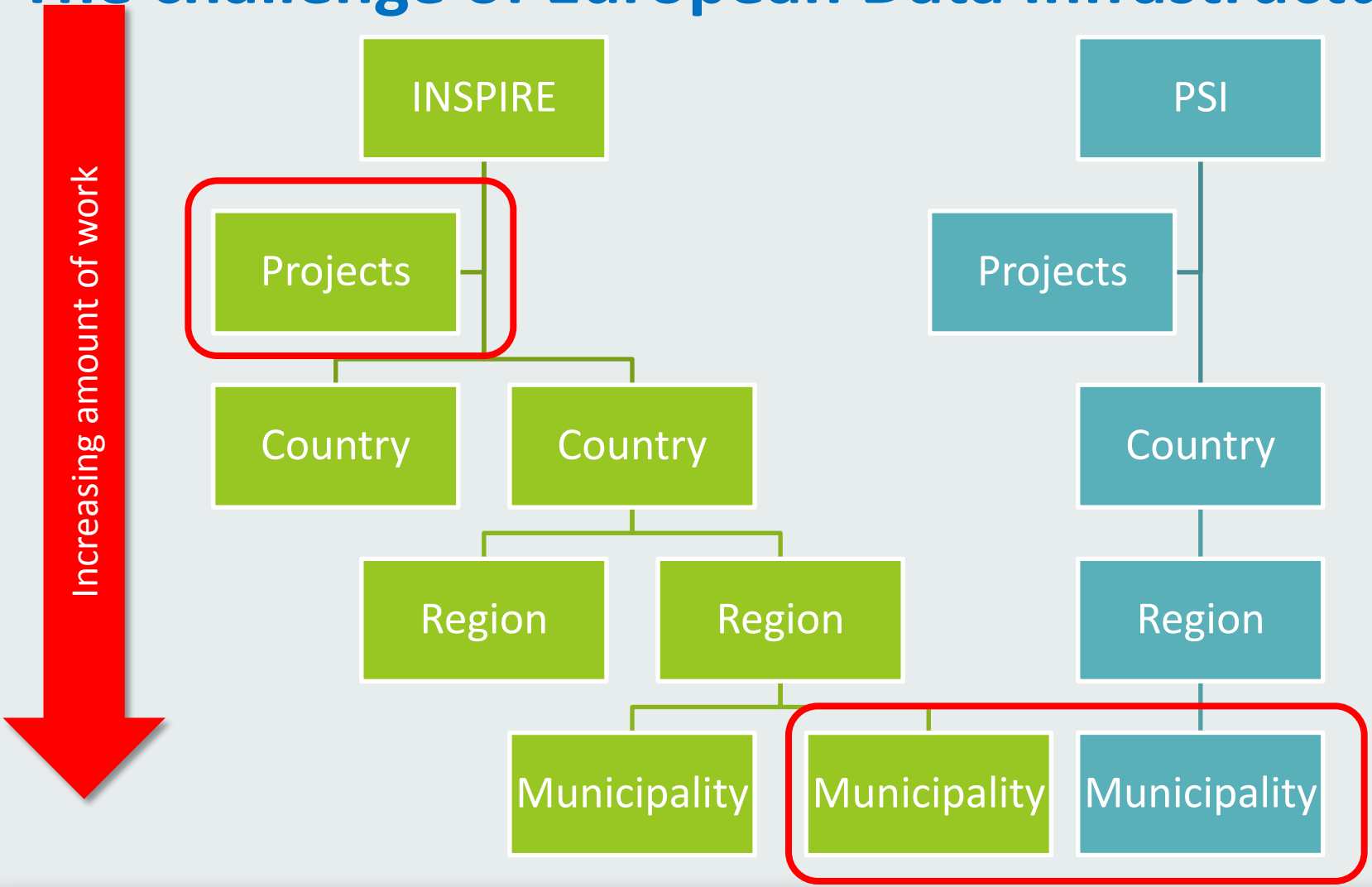
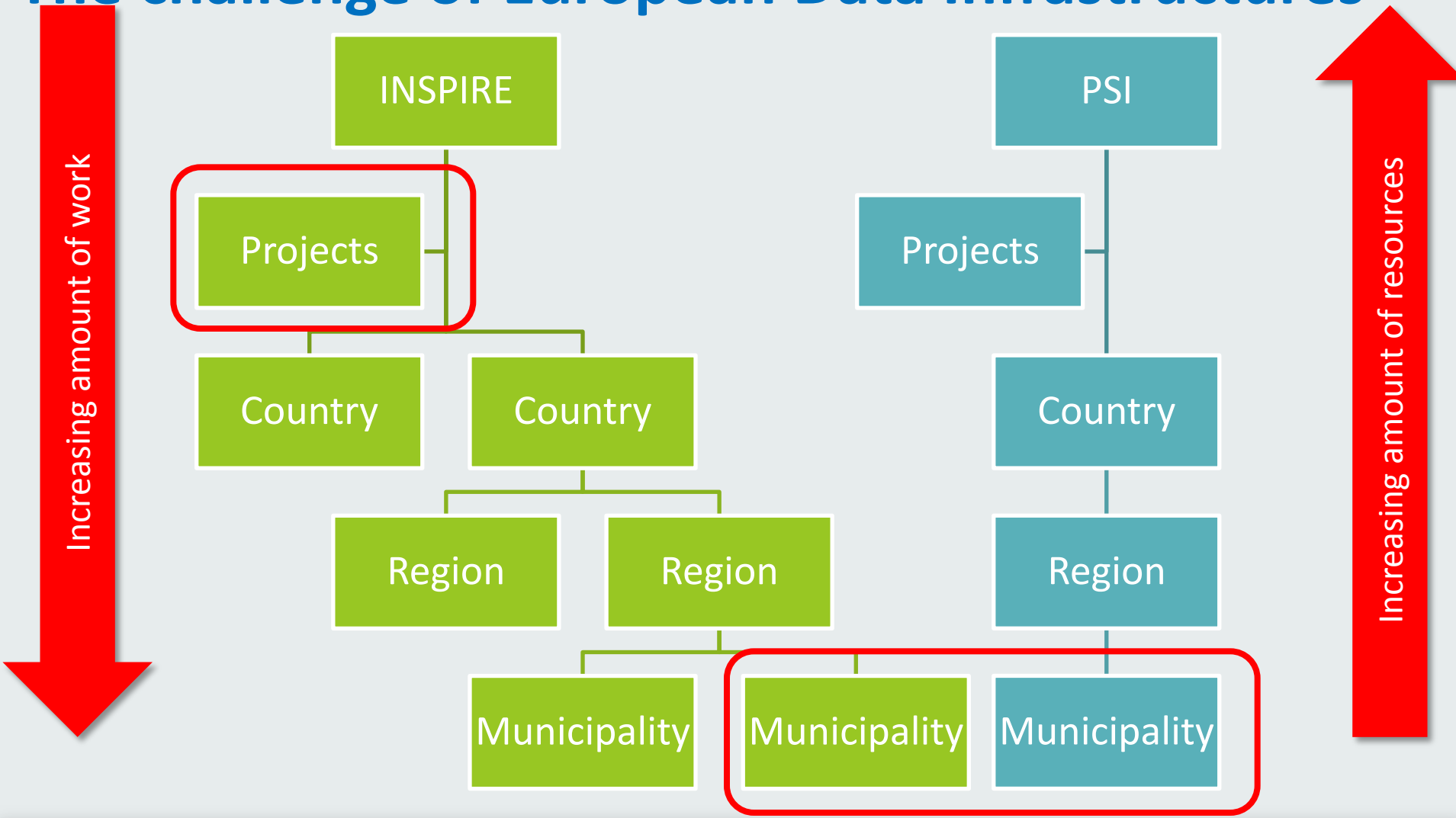


The challenge of European Data Infrastructures



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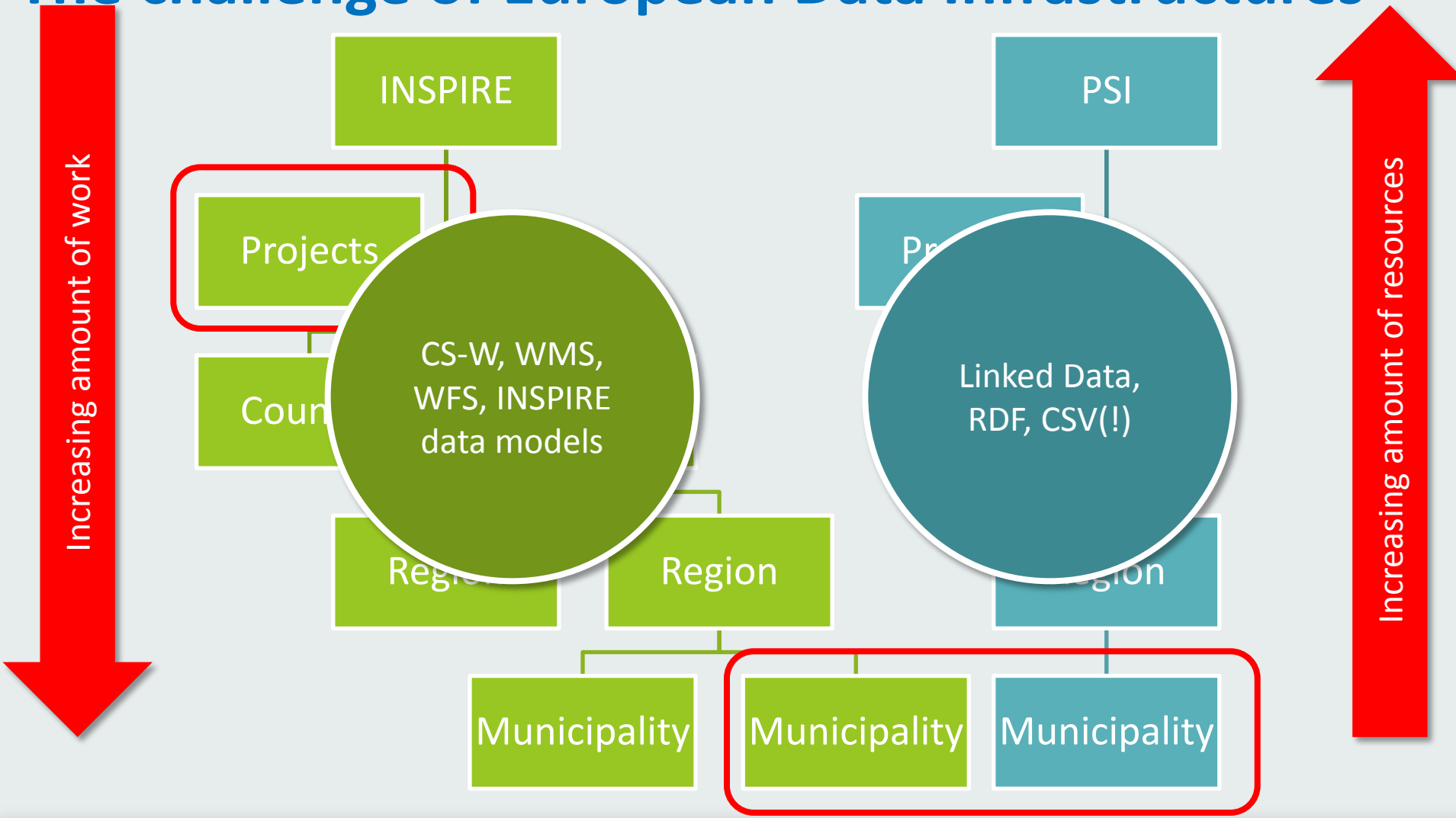

The Hub concept

GeoSmartCity "Hub" is a software and hardware platform to catalogue, store, and make data available through web APIs.

The server software components expose interfaces for integrating, visualizing, analyzing and processing spatial and non-spatial data sources, allowing users to upload or connect their data sources, configure map visualizations and publish data through a web based user interface.

Components in «the Hub»

The pieces that make up the puzzle

Components

The **open data hub** is based on CKAN and other open source solutions, connected to **View and Download Services** provided GeoServer and enhanced by specialized pilot-driven geo-processing services.

GeoSmartCity Hub

What is the Hub? | Project website | Contact Us | Log in

The list of installed basic applications is:

- Apache 2.4.7 (Web server)
- Tomcat 7.0.62 (applications server that cointains applications packed as war)
- PostgreSQL 9.5.2 (Database server)PostGIS 2.2.1 (Spatial and Geographic objects for PostgreSQL extension)
- pgRouting 2.1 (Routing library for Postgis)
- OpenTripPlanner (Multimodal trip planning & analysis application)
- Virtuoso 07.20.3212 (database engine for RDF)
- SOLR 5.2.1 (indexer and search engine)
- CKAN 2.4 (Open-source data portal platform)
- GeoServer 2.7.1.1 (Map Server)
- Geonetwork 3.0.3.0 (Geospatial catalog)
- Geowebcache (Geoserver extension that create cache for layers)
- Re3gistry 1.0 (INSPIRE registry of codelists, codelist values and feature concepts)
- Python 2.7.6 (Programming language)

> The GeoSmartCity HUB is distributed as a SaaS service or as virtual machines based on Ubuntu Linux available for download, in order to allow the reuse of all the software components developed for the project.

The benefit of the Hub lies simultaneously in:

- its innovative approach to bridging and bringing together public sector data infrastructures
- its extensive use of well-known open standards;
- its simplicity of implementation

Hub Core resources

GeoSmartCity Data Catalogue

An applicatiton to catalog different data sources, publish all or some of this information and produce a configuration JSON for its map display.

Data Catalogue

GeoSmartCity Data Portal

Data discovery in GeoSmartCity is managed by an instance of the CKAN software augmented by three extensions for custom metadata management.

Data Portal

GeoSmartCity Client Side API

A library for rapid spatial web application development. The library builds on jQuery, OpenLayers3 and invokes methods from the GeoSmartCity Hub.

Client API

Hub Support resources

Validation Service

On-line validation of datasets harmonized according to the GeoSmartCity target data models.

Validation Service

Geospatial Catalogue

A cataloging application for spatially referenced resources. It provides metadata editing and search functions.

Geospatial Catalogue

Codelists Manager

The JRC's Re3gistry is reused and extended in order to manage new codelists and codelist values.

Codelists Manager

Specialised Services

Standardized and re-usable data processing services based on requirements coming from the GeoSmartCity Pilots.

Specialised Services

Components

GeoSmartCity Hub

What is the Hub? | Project website | Contact Us | Log in

Hub Core resources

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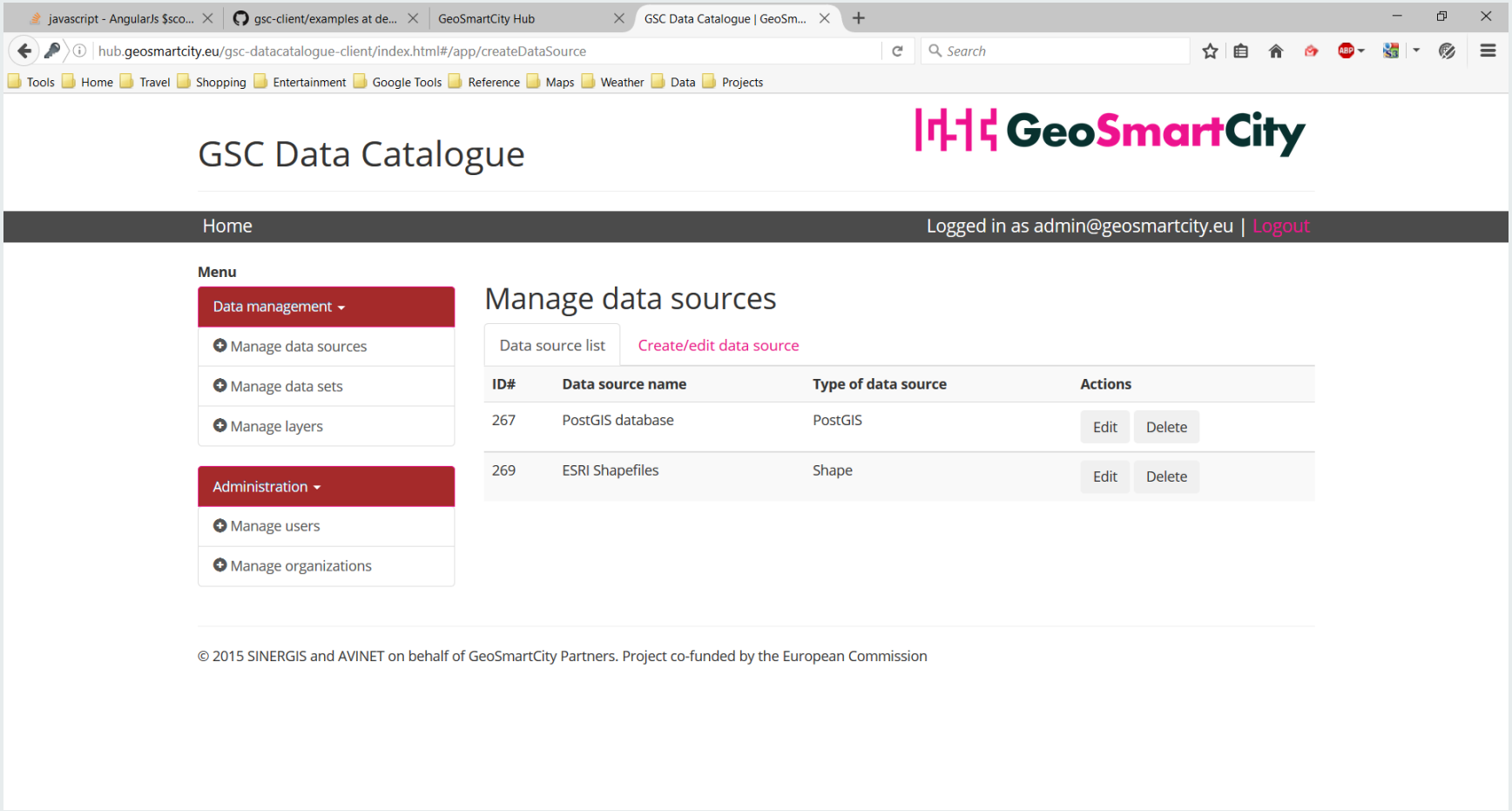
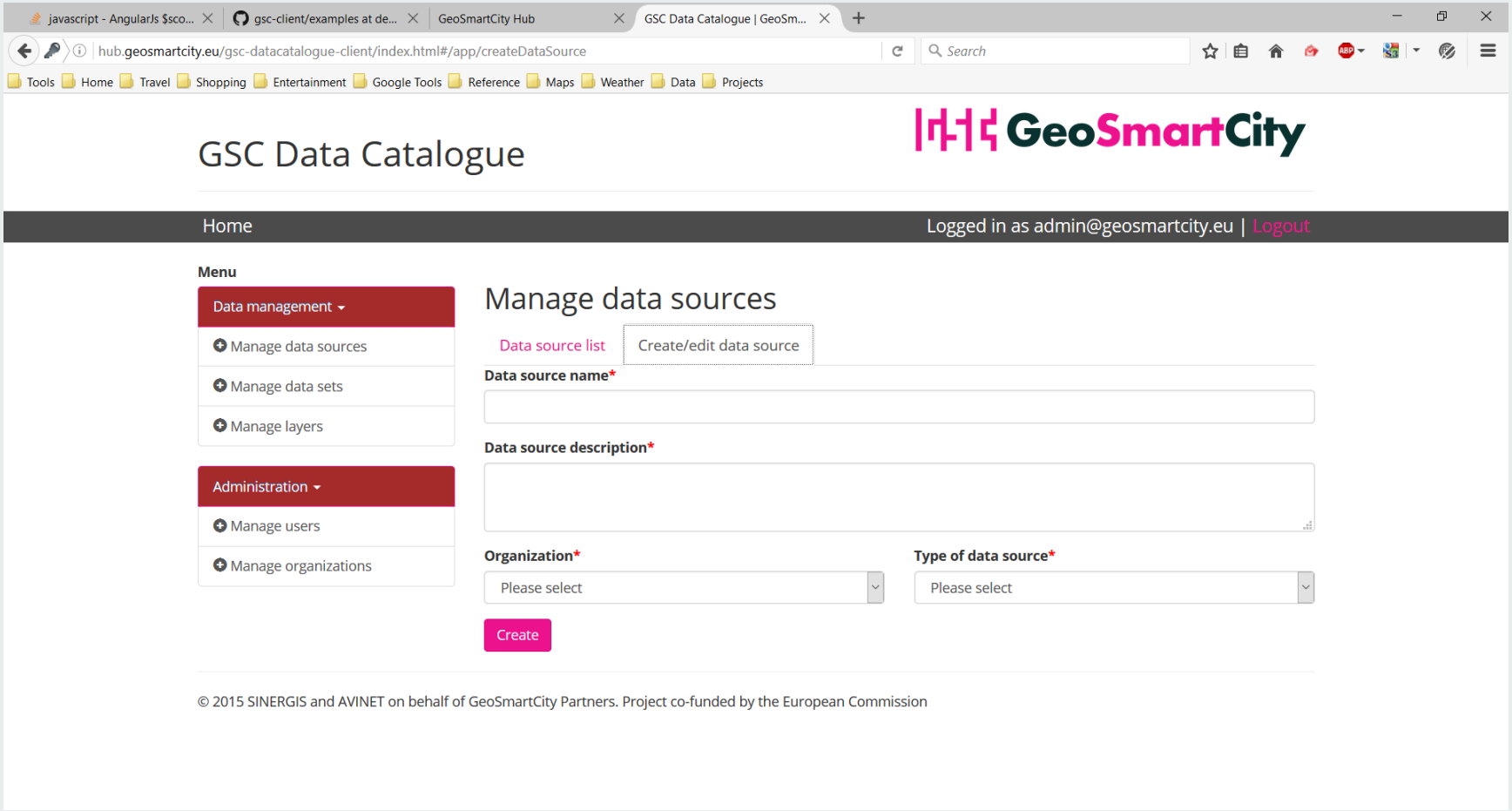
Client API

Hub Support resources

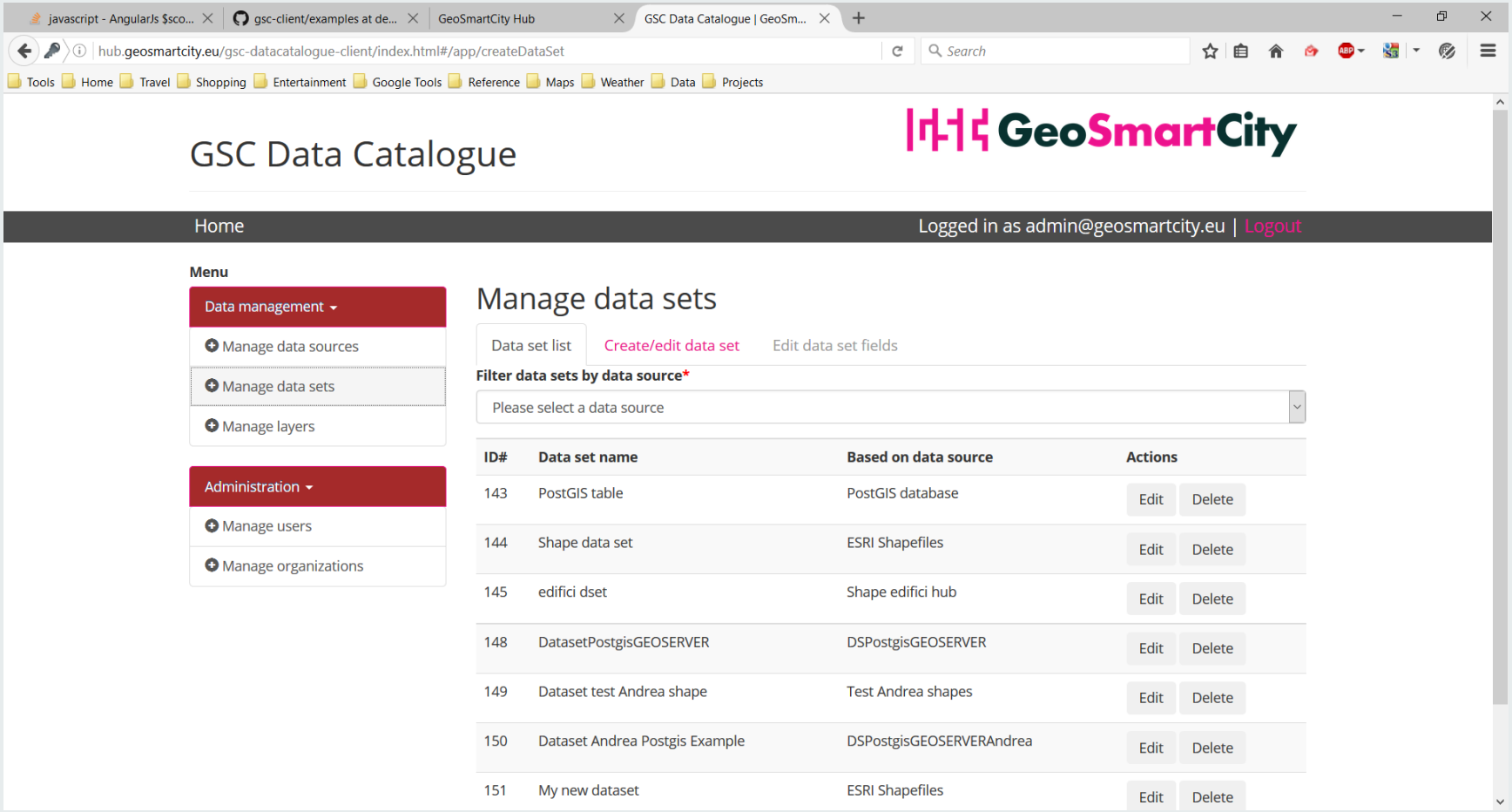
Manage data sources



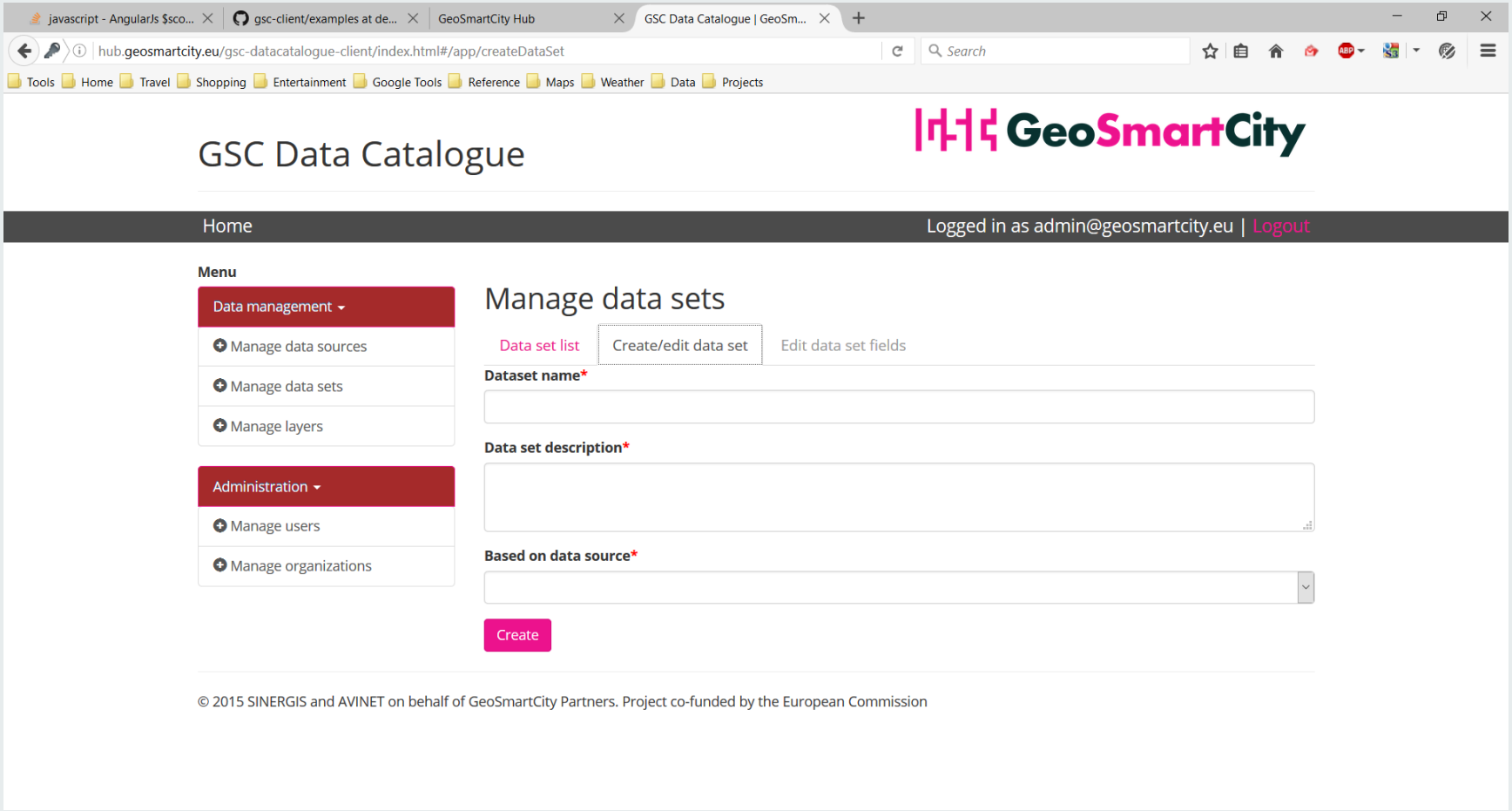
Create/edit data sources



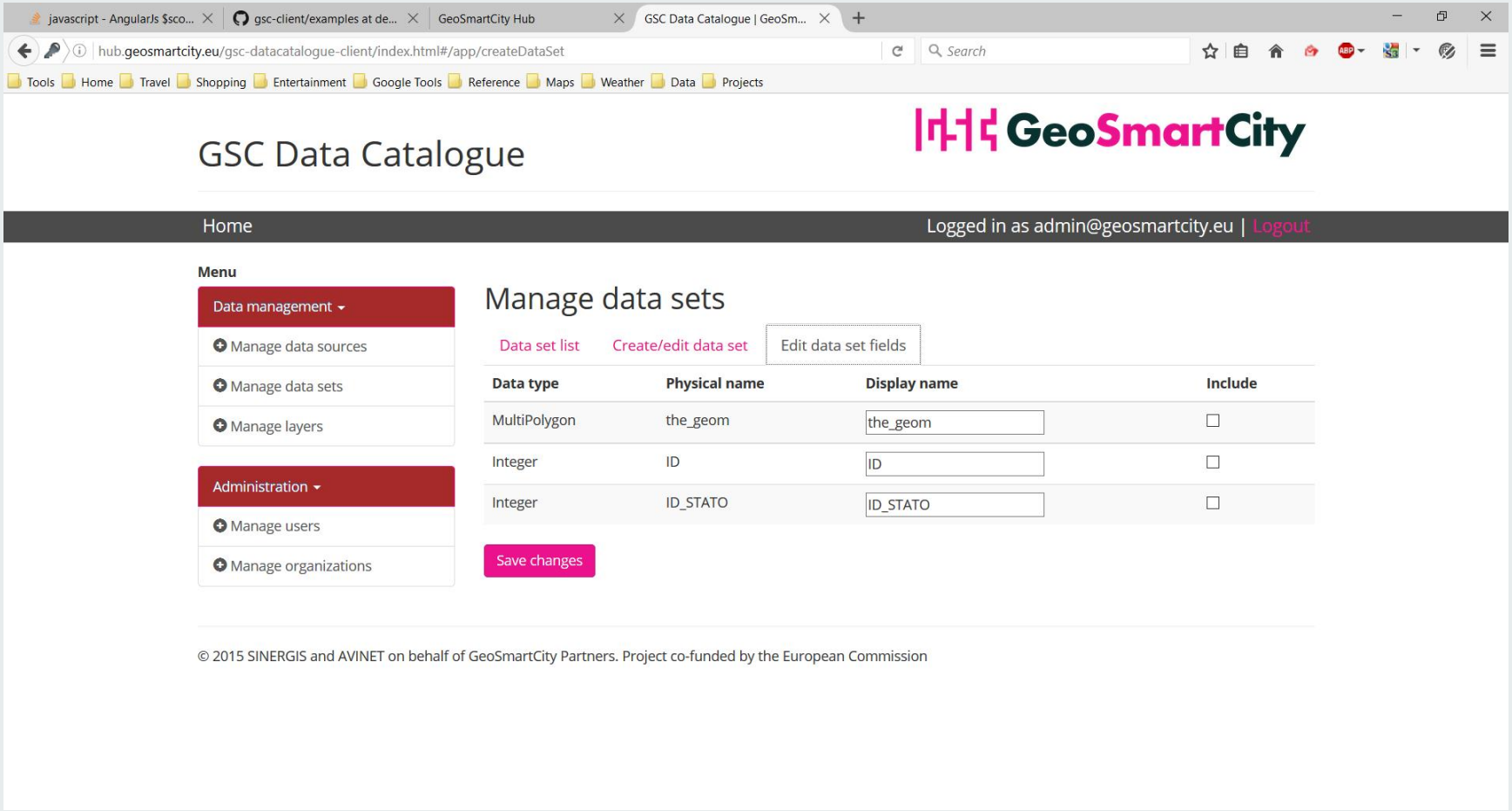
Manage data sets



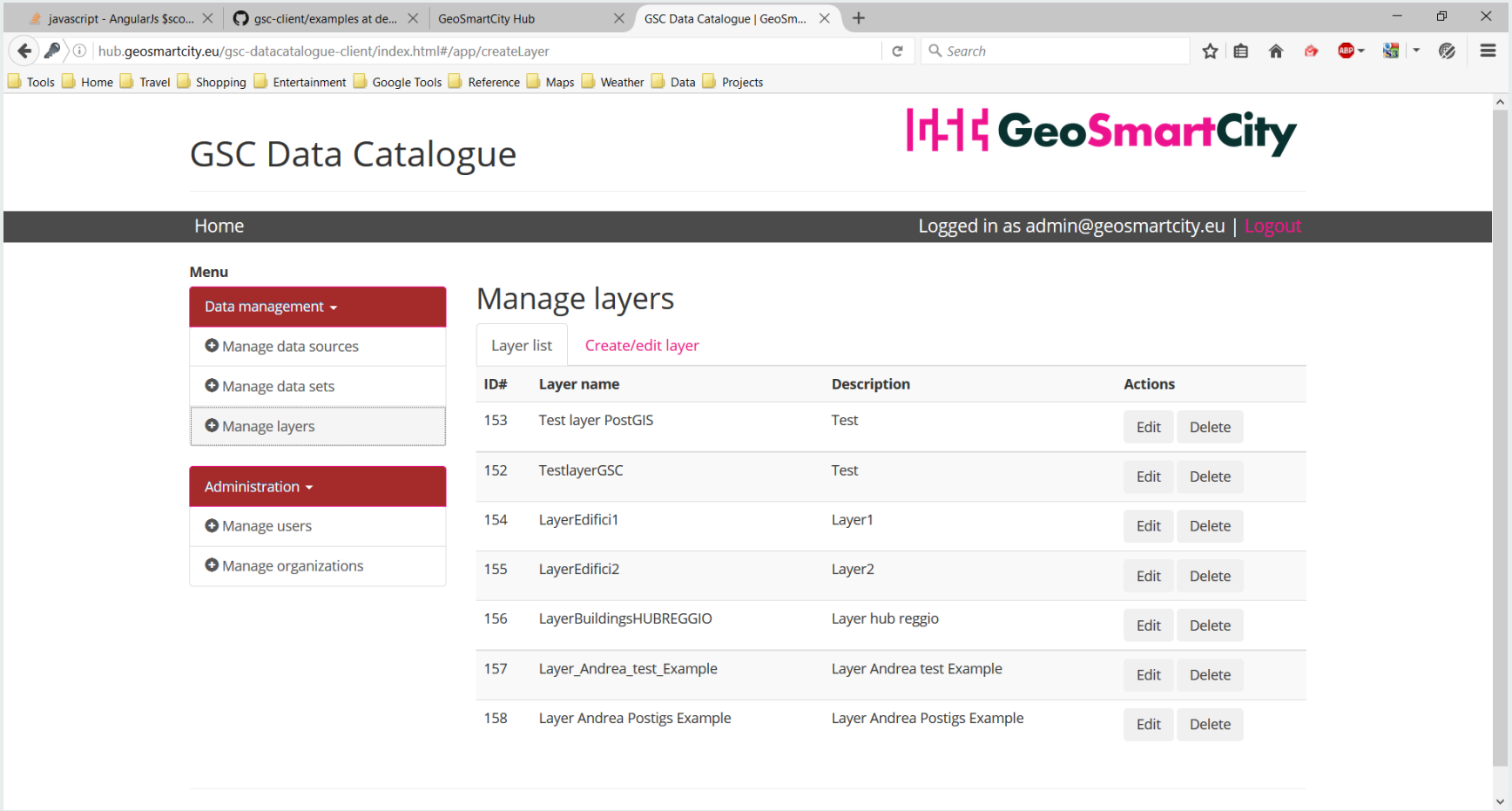
Create/edit data set



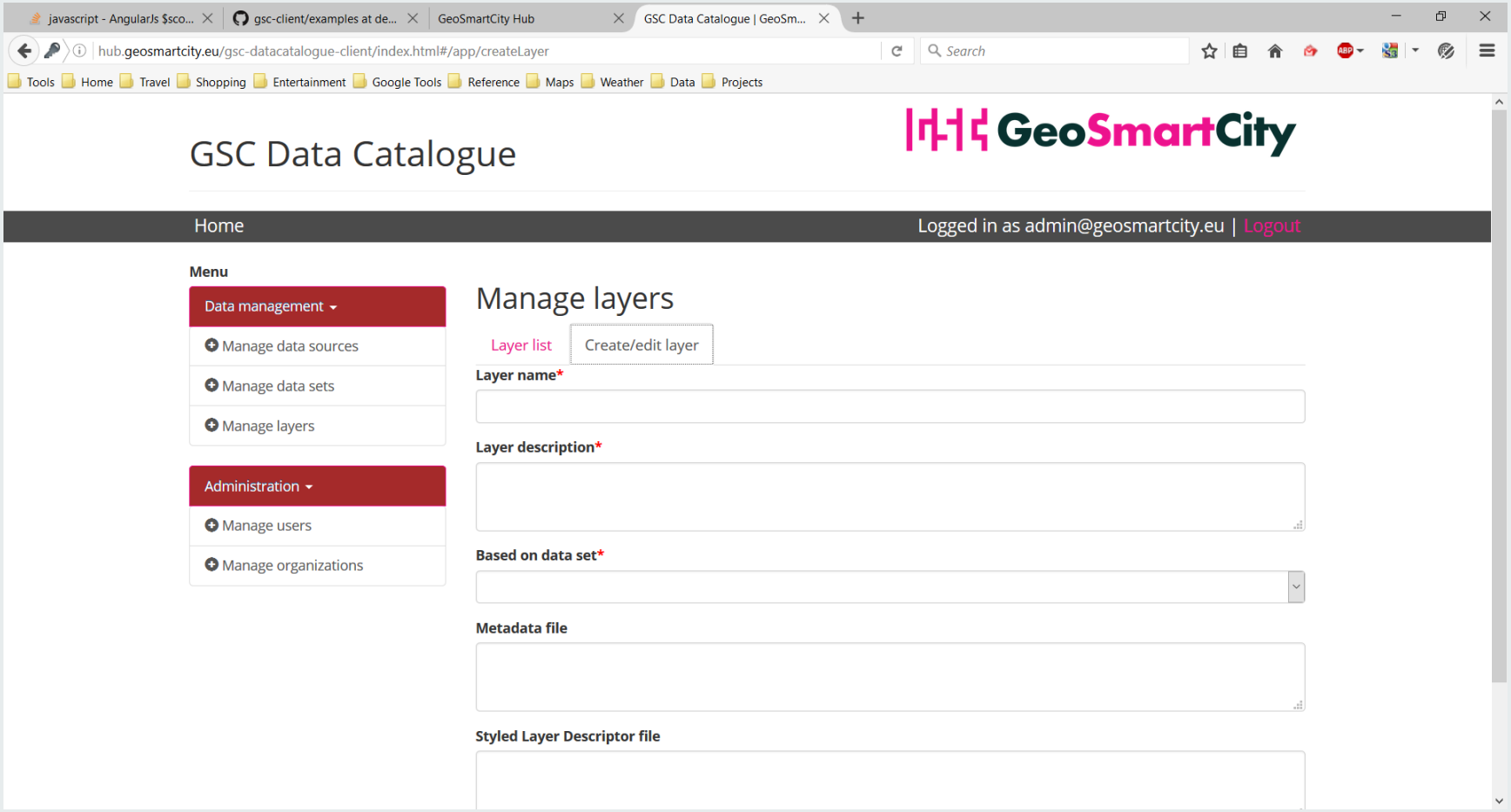
Edit field aliases



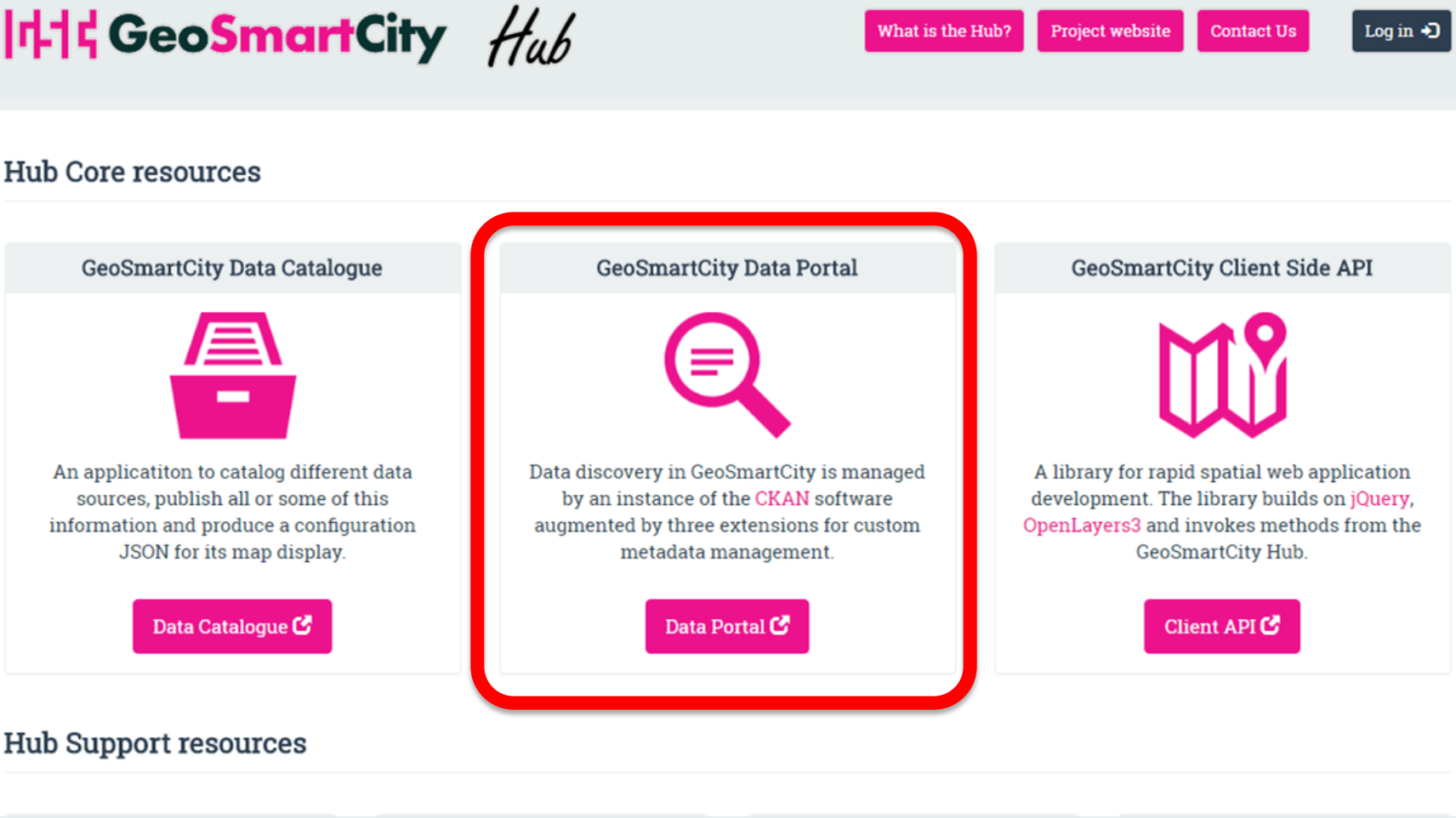
Manage layer



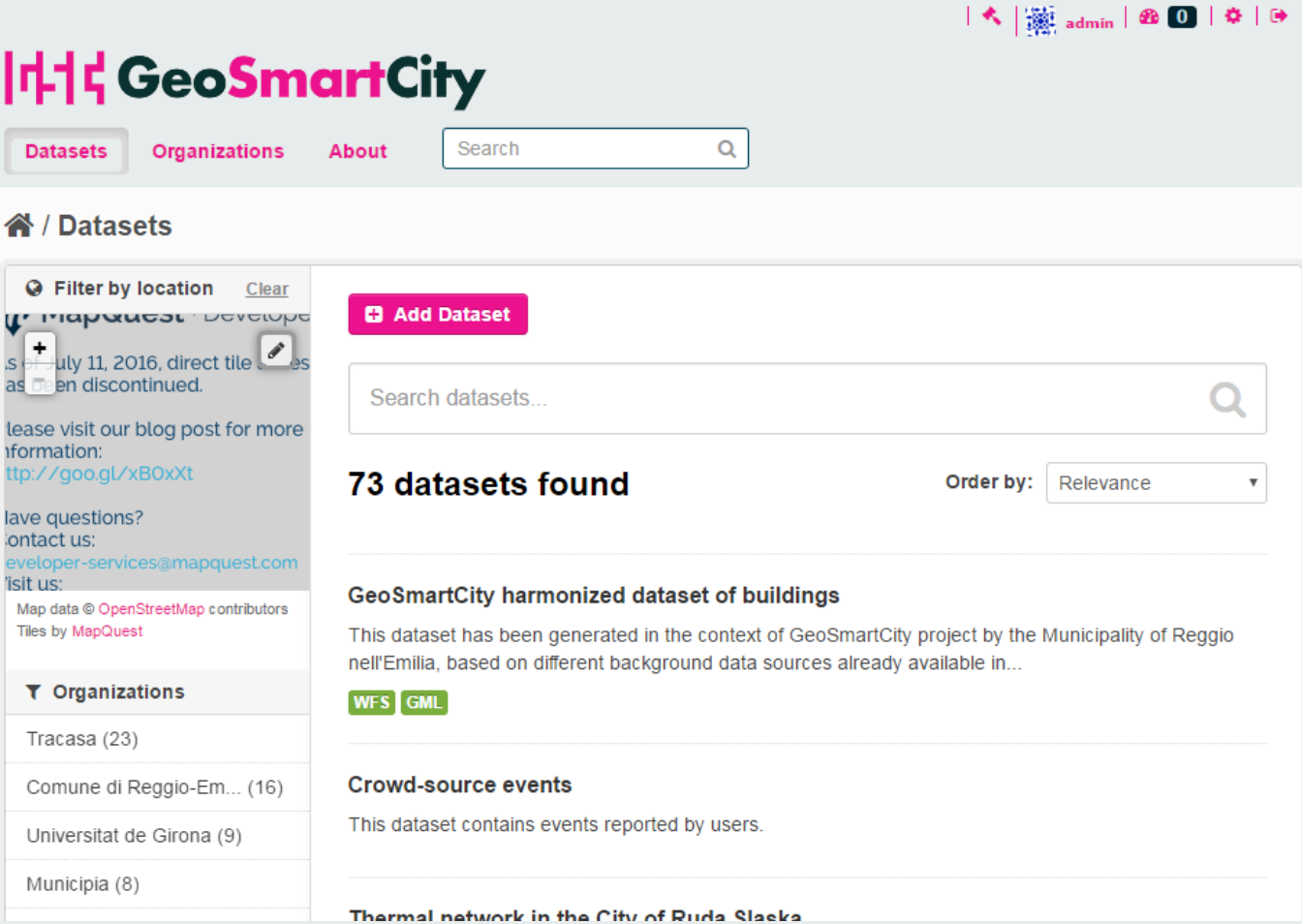
Create/edit/publish layers



Components


GeoSmartCity Hub
What is the Hub?
Project website
Contact Us
Log in
Hub Core resources
GeoSmartCity Data Catalogue
An applicatiton to catalog different data sources, publish all or some of this information and produce a configuration JSON for its map display.
Data Catalogue
GeoSmartCity Data Portal
Data discovery in GeoSmartCity is managed by an instance of the CKAN software augmented by three extensions for custom metadata management.
Data Portal
GeoSmartCity Client Side API
A library for rapid spatial web application development. The library builds on jQuery, OpenLayers3 and invokes methods from the GeoSmartCity Hub.
Client API
Hub Support resources

Components (Data Portal)



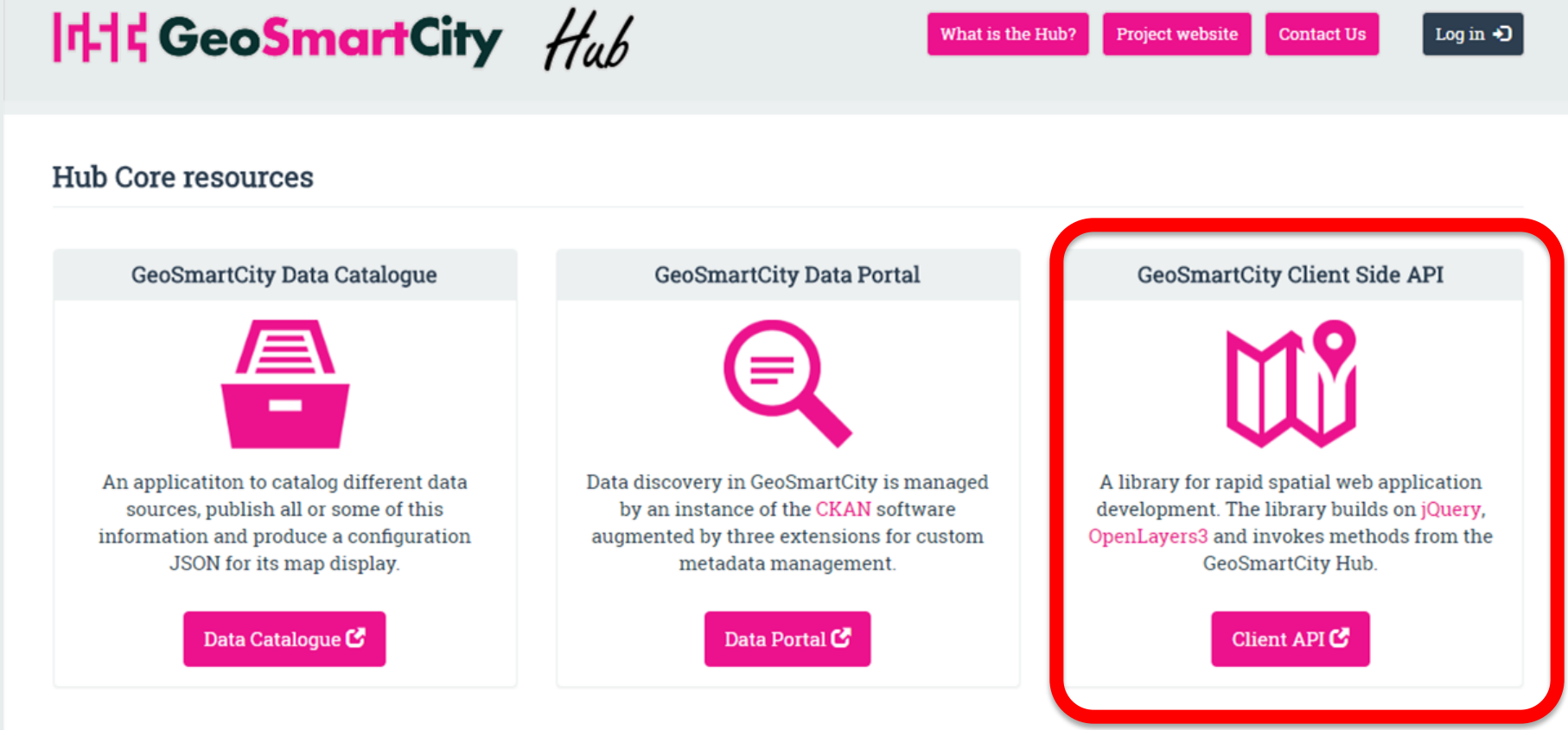
The importance of being … 'harmonized'

The importance of being … 'harmonized'

Generic workflow to transform datasets according to selected target schema requirements

- Import target/source schemas
- Import data
- Set mapping rules
- Export transformed data
- Validate transformed dataset

Components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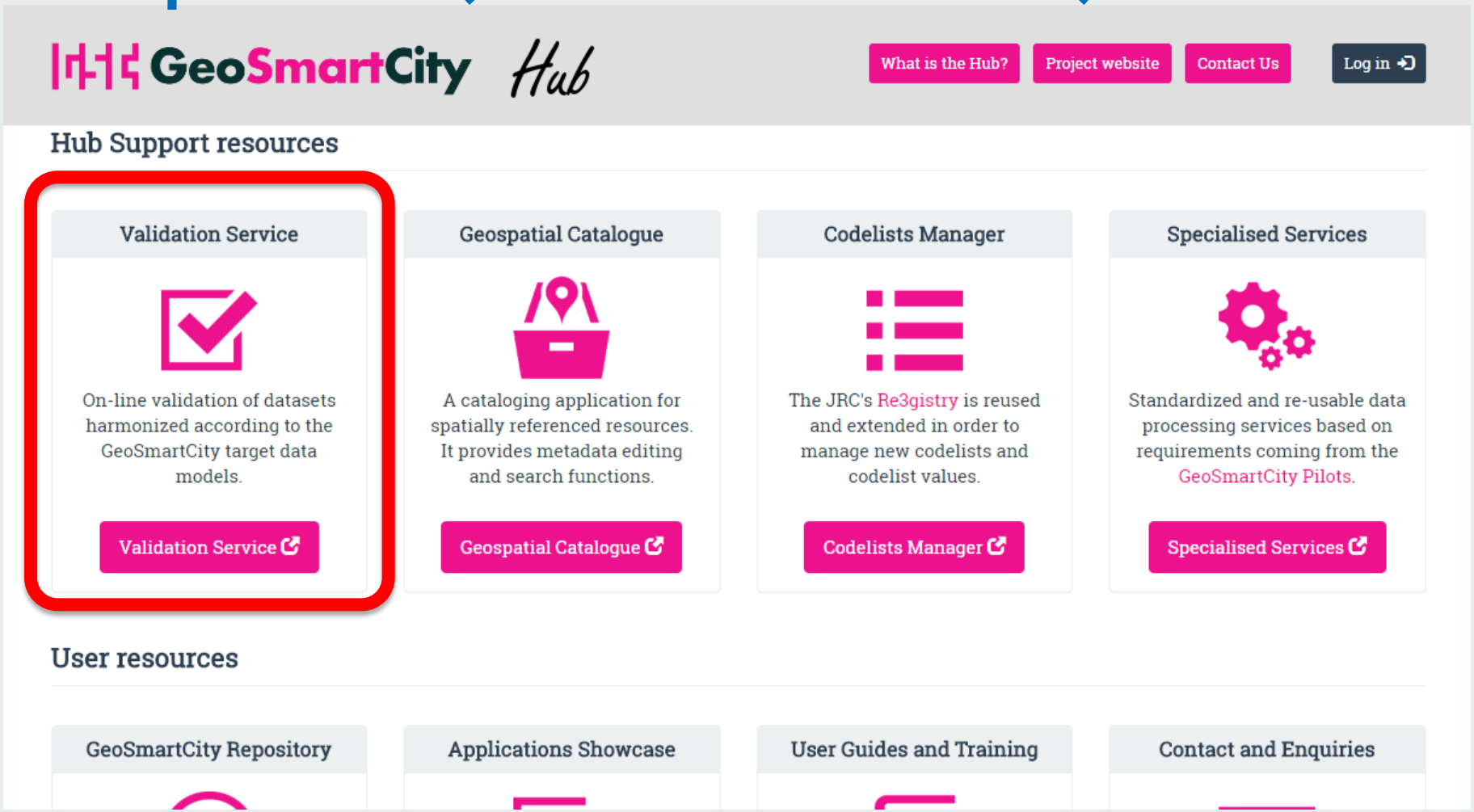
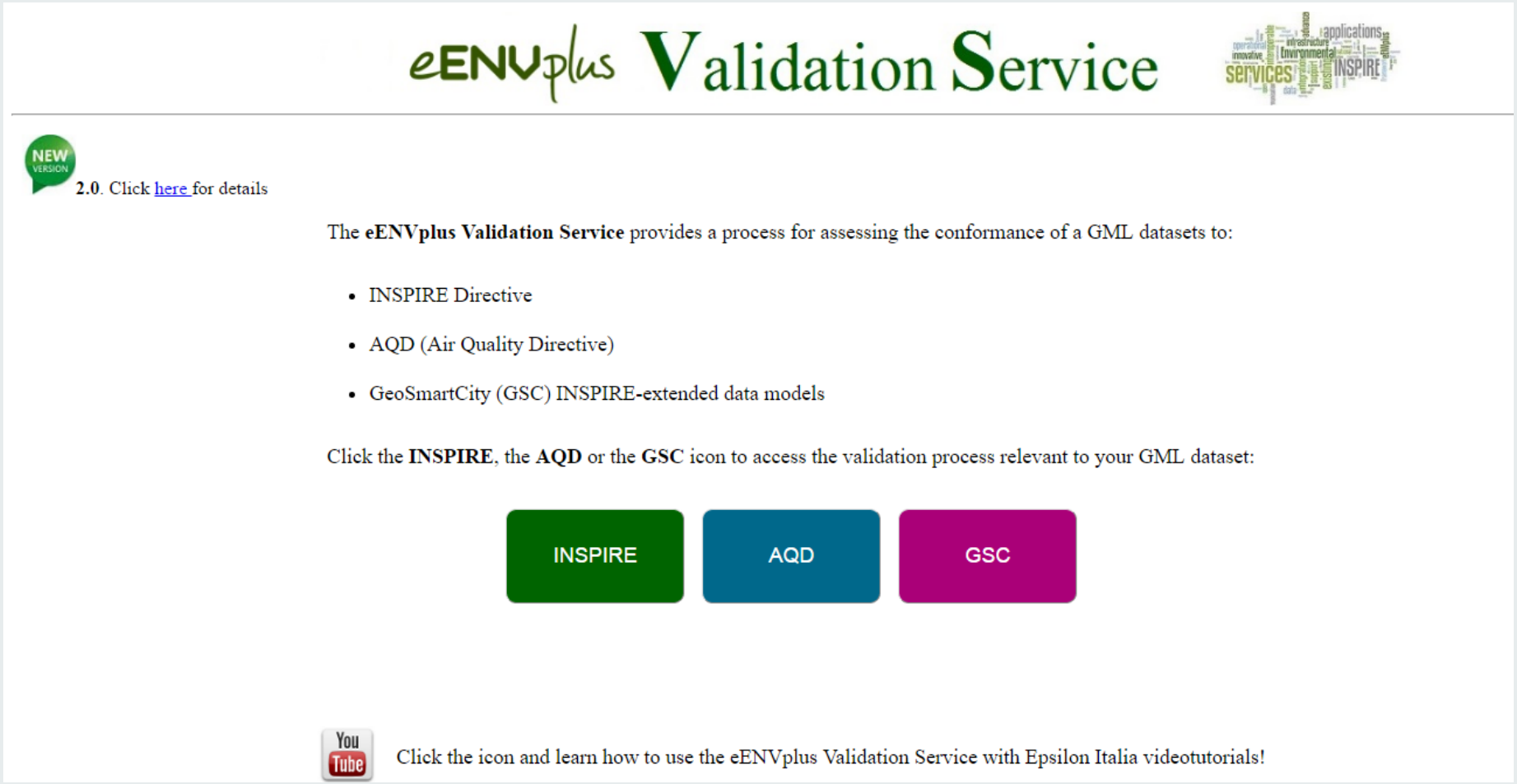
JavaScript (a professional platform)

Gsc.js: spatial «Lego» for rapid application development

Components (Validation Service)

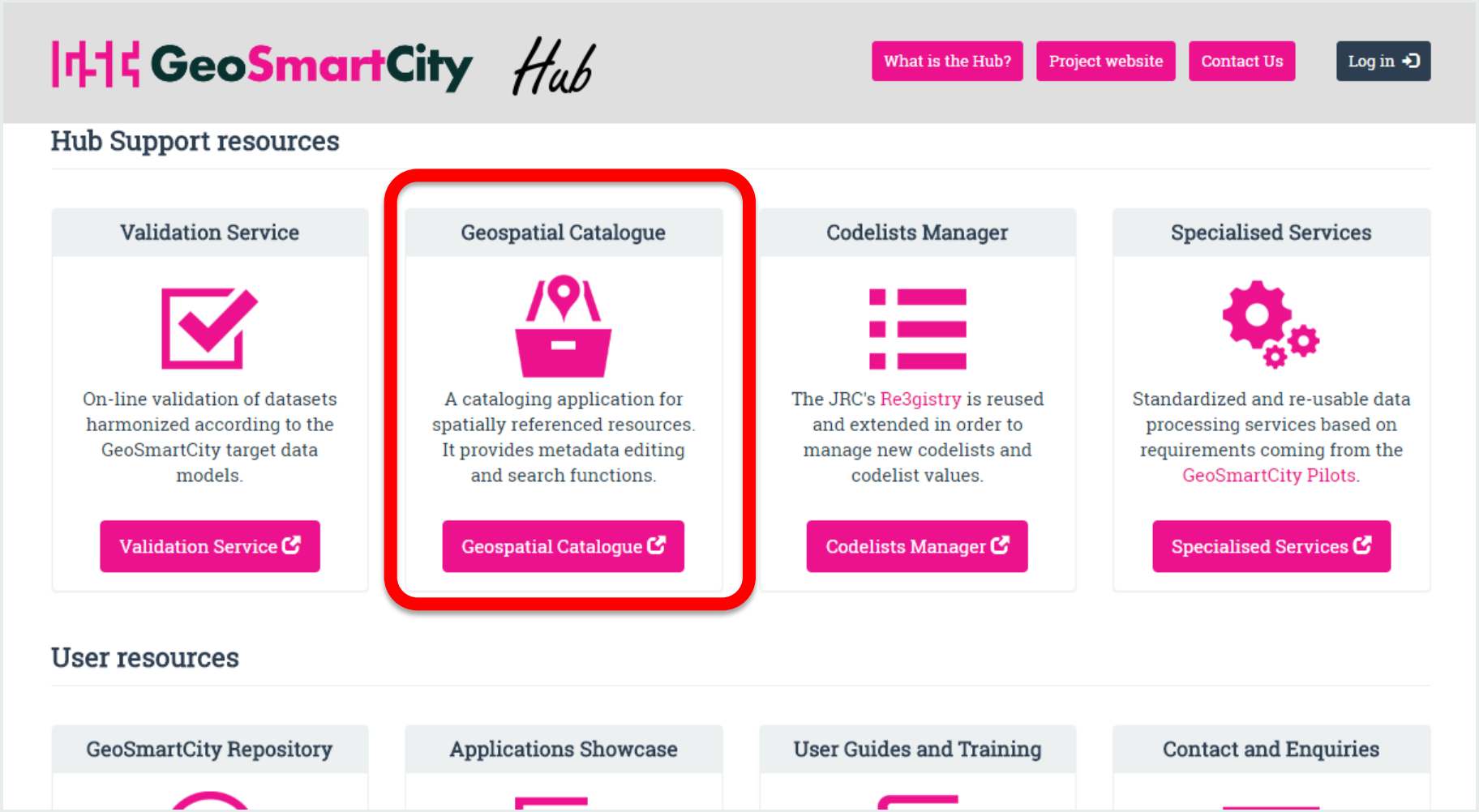


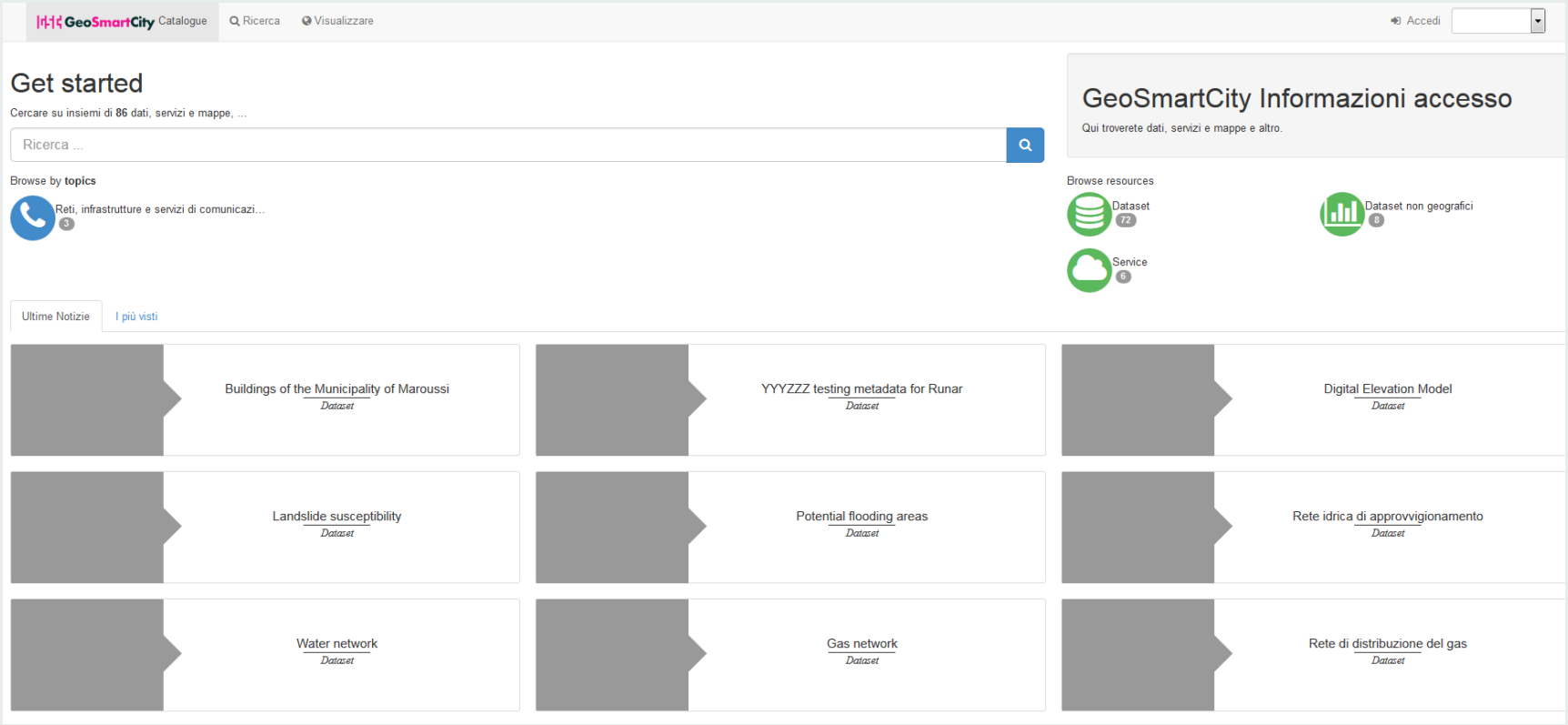
Components (Validation Service)



Extended from eENVplus project

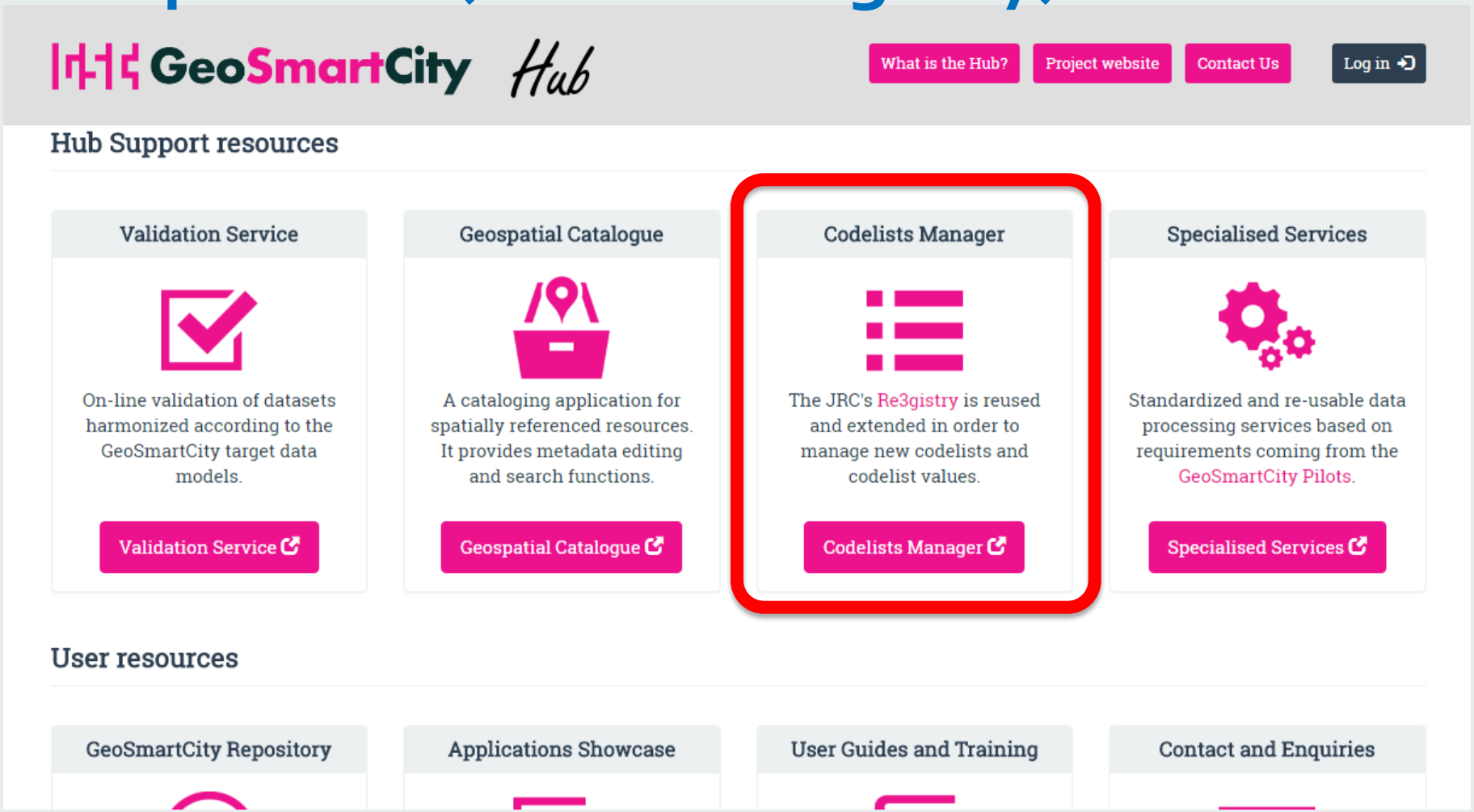
Components (Geospatial Catalogue)



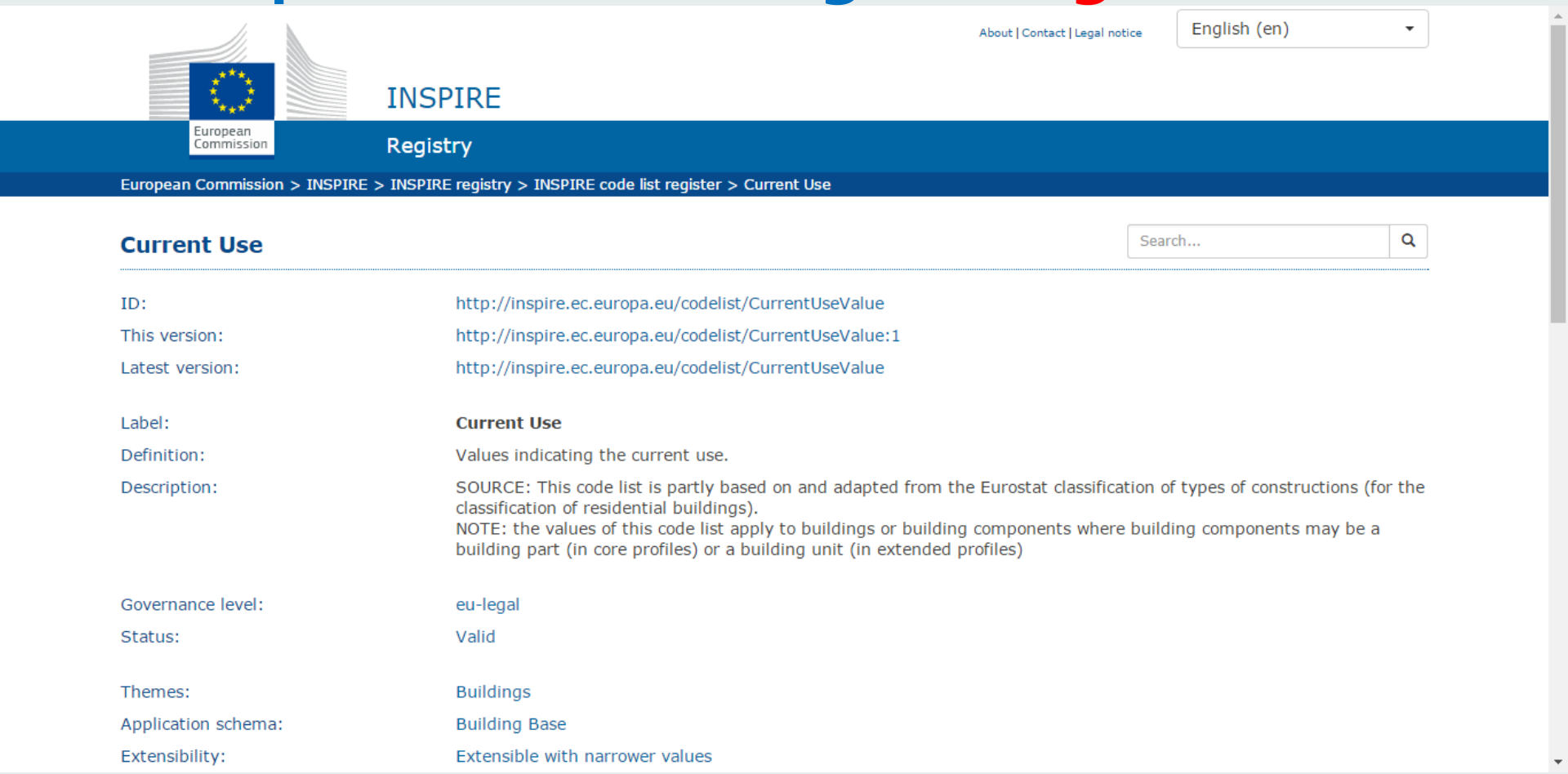


A cataloging application for spatially referenced resources.
It provides metadata editing and search functions for all the Pilots

Components (Codelist Registry)

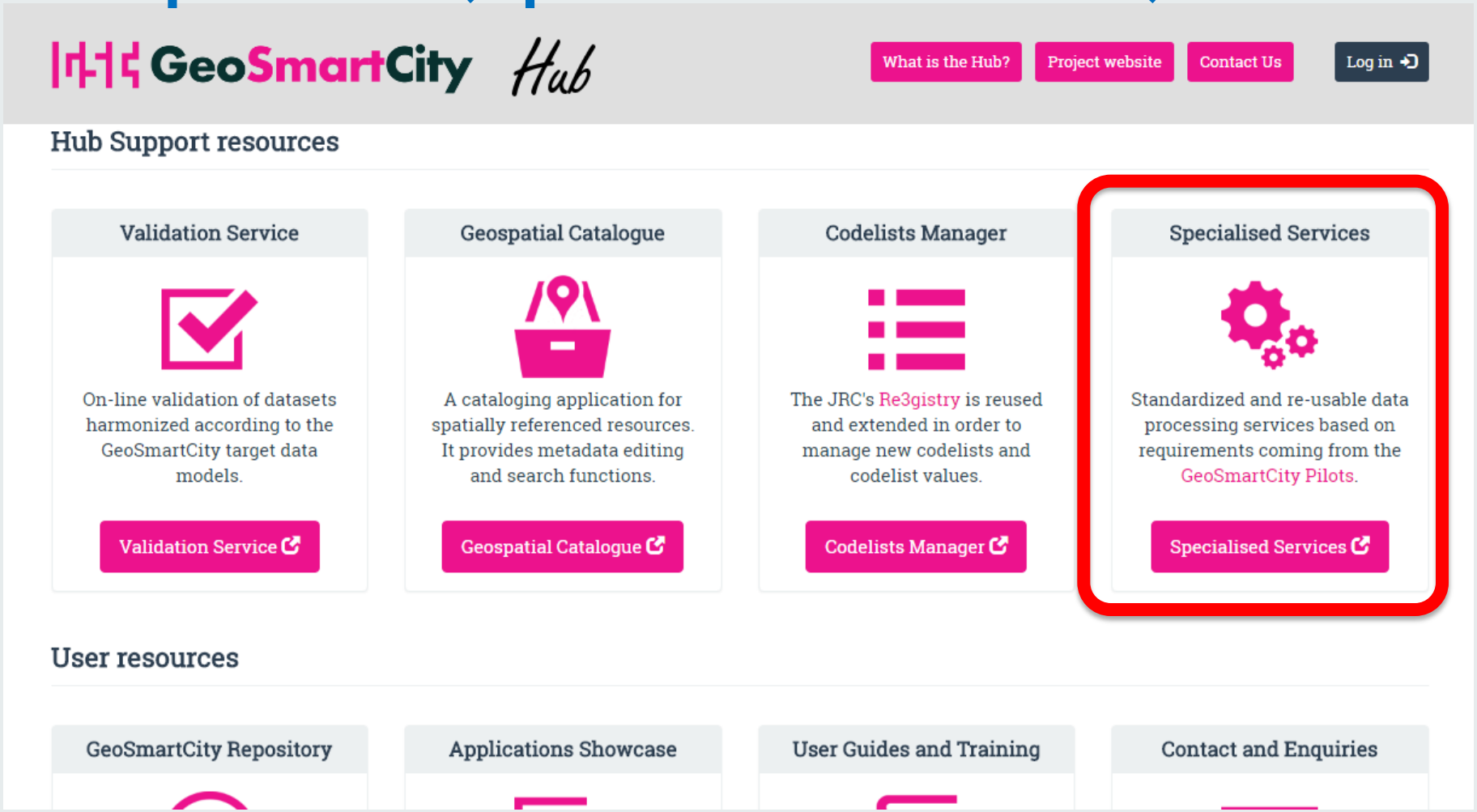


The importance of being … 'Registered'

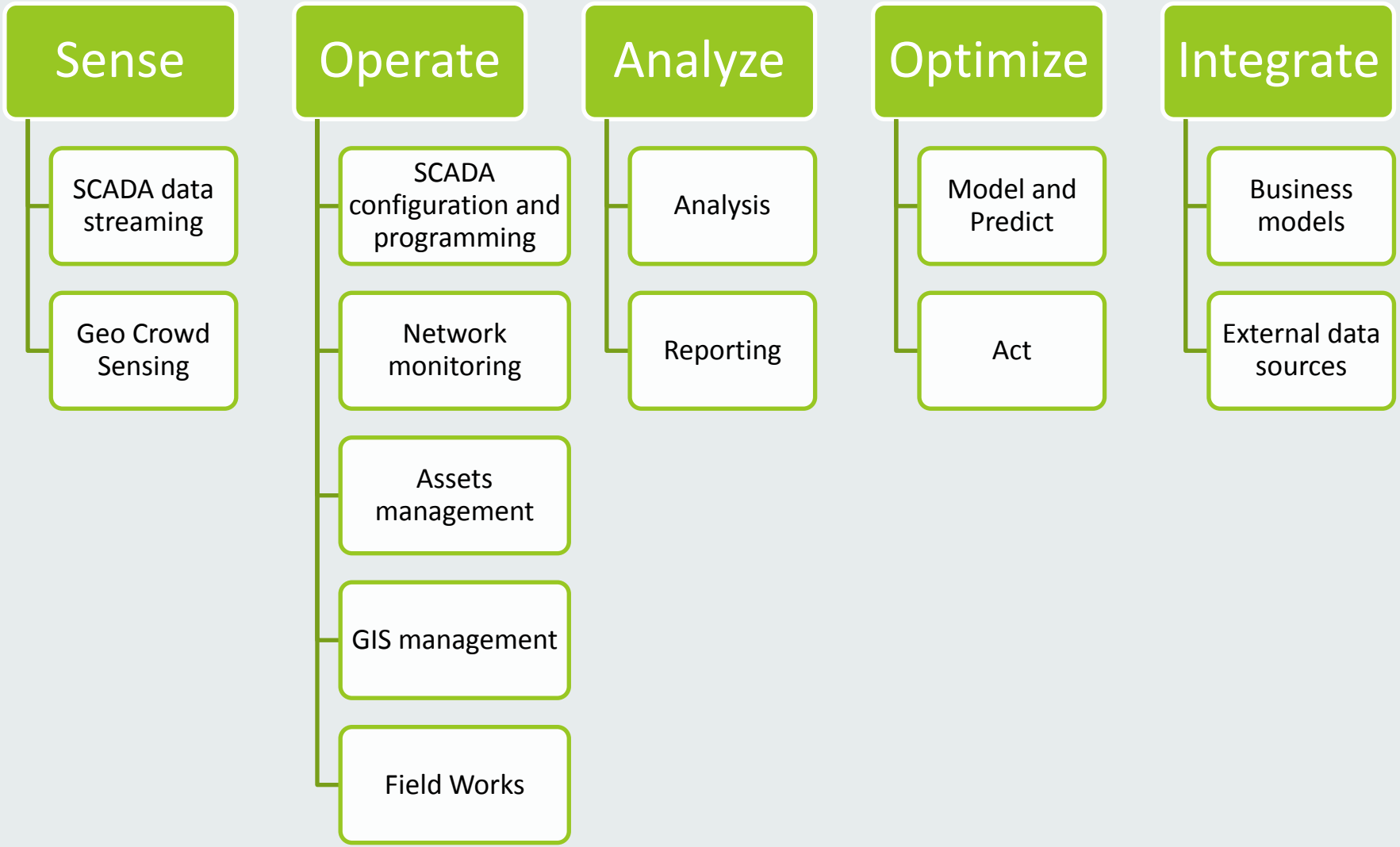


http://inspire.ec.europa.eu/codelist/CurrentUseValue

Components (Specialized Services)



Underground domain



Underground specialized services / 1

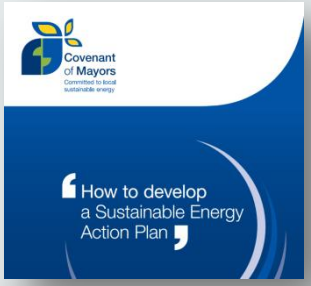
- Geo crowd-sensing client
- Geo crowd-sensing mobile client
- Geo crowd-sensing platform management
- Field work verification and correction
- Creation and sharing of personalized maps
- Field work orientation through augmented-reality

Underground specialized services / 2

- Analysis of interaction between hazards and underground networks
- Tracing of sewage network
- Use of GIS and SCADA information
- GIS access to Sensor data streaming services

Green Energy domain

- **Editing**
  - **Bdgs properties**
  - Bulk uploads (new bdgs)
  - **OSM alignement**
- **Deriving**
  - **EPB**
  - **CO2**
  - Solar potential
  - Drive to park
- **Routing**
  - Multilingual Geocoding
  - **CO2 emitted**
  - **CO2 monitored**
- **Presenting**
  - Dashboard
  - Report



http://www.eumayors.eu/IMG/pdf/seap_guidelines_en-2.pdf

Green Energy specialized services / 1

- Buildings "on-site" data quality check
- Estimation of Energy Performance of buildings
- Buildings CO_2 emissions estimation
- Heat consumption dashboard
- Green Energy report
- Upload of "future "buildings datasets
- Solar potential calculation
- Zero-balance layer

Green Energy specialized services / 2

- Multi-lingual Address Geocoding
- Green preferences and routing
- Next departure time
- Drive to park

See more in the next presentations…

10.15 - 11.45	- The GSC extended data models and the data harmonisation methodology - The Pilot in Ruda Śląska - The GeoSmartCity Training Framework
Smart cities in Poland	
12.00 - 13.30	- Adam Iwaniak – Wroclaw University of Environmental and Life Sciences - Robert Olszewski – Warsaw University of Technology - Paweł Sikora - Silesian University of Technology

The final outcome of GeoSmartCity is a long-term sustainable open network of stakeholders.

All the interested stakeholders are very welcome to join the GeoSmartCity Community.

Adhesion to the GeoSmartCity Network

You will receive an inviation