



WHITE BOOK FOR THE WEB BASED DECISION SUPPORT AND INFORMATION TOOL

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1. Introduction

1.1. The regional web based decision support and information systems

The web based decision support and information system provides tools to display key values for evaluating the potential of use and possible conflicts of use associated to shallow geothermal energy use for the 6 pilot areas selected in GeoPLASMA-CE. The decision support and information system (DSIS) will be freely accessible and may be transferred to other regions in Central Europe after the end of the project, as all documentation of the web tools will be made publically available. The DSIS will be slightly regionalized for the 6 pilot areas in order to fulfill the needs of local stakeholders, which are represented by:

- Local and regional authorities for managing the use of shallow geothermal systems
- Energy and land-use planners
- Policy makers and administrative bodies
- Professionals in the fields of shallow geothermal use (e.g. installers or planners)
- Investors and the interested public

The 6 regional DSIS will be hosted at the project related web portal (www.geoplasma-ce.eu) and perform, in combination with the international expert platform, the main technical outputs of GeoPLASMA-CE.

1.2. Scope of this deliverable

This report presents a general concept of the web based decision support and information systems (DSIS), which are slightly tailored (regionalized) for the 6 pilot areas of GeoPLASMA-CE. It will describe all relevant features and presents mockup graphics of the planned layouts summarized to a so called White Book. It also covers the specific thematic outputs that will be delivered to PP10-GiGa by the project partners for being displayed in the web based decision support and information tool. This covers the layers that are supposed to be available in the web GIS as well as the content that is supposed to appear in the reports of location specific queries. Another part of the White Book will deal with the features that were mentioned in the Catalogue of Requirements but will not be realized. For each of these features, an explanation is given why the feature will not be realized.

The White Book represents a living document until all features of the DSIS have been realized. Any changes, which will be applied to the general concept or layouts will be documented in updated versions of this report.

1.3. Road to the White Book

This White Book refers to the catalogue of requirements (Deliverable D.T1.1.2) and represents the next step for the realization of the GeoPLASMA-CE web portal (www.geoplasma-ce.eu). The main concept of the international expert platform is described in an individual White Book (Deliverable D.T1.4.1). All features that were considered as highly important in the catalogue of requirements were taken into account for creating this White Book. At a workshop in Freiberg on 17th of May



2017, the web based decision support and information tool was discussed internally with the partners from the project. The goal of the workshop was to get a final list of features that will be developed for the web based decision support and information tool. The results of this workshop, together with further internal discussions and an estimate of the hours necessary to develop the single features are the base for this White Book.

1.4. Examples of existing web based information tools relevant for GeoPLASMA-CE

Tools with a similar goal and a similar set of features already exist on the web. In that context, Germany represents the European country having the highest amount of web based decision support and information tools in Europe. Examples from Germany are given by ISONG (<http://isong.lgrb-bw.de/>), the web based information system on shallow geothermal use in Baden Württemberg or by the Bavarian IOG system (<http://www.umweltatlas.bayern.de>). Both systems cover the entire area of the respective state and allow location specific queries.

Outside of Germany, other examples are given by:

The Dutch WKO tool (<http://www.wkool.nl/>), which offers information about different geothermal installations in a web GIS format for the Netherlands. Some of the functionalities that this system offers, like displaying different GIS layers on a map, will also be implemented in the decision support and information tool of the GeoPLASMA-CE project. However, the WKO tool has a specific regional scope on the Netherlands and it targets a different use case. It offers specific planning features like a financial overview that will not be implemented within the GeoPLASMA-CE project as the decision support and information tool is not supposed to be a competition for planner offices or installers. The GeoPLASMA-CE web platform will generate a report for a user on a queried location that gives an overview about the feasibility of a geothermal installation. The user has to take the next steps and contact planner offices, e.g. one that was found on the local expert platform within the decision support and information tool.

Another site about geothermal energy is “Optimierung von Erdwärmesonden” (Optimization of geothermal heat exchangers) (<http://www.erdsondenoptimierung.ch/>). It is a site that offers a lot of information on the topic of geothermal energy. It can be seen as an inspiration for content that would fit well with the local expert platforms and the international expert platform.

In the Austrian region Salzburg, a web based information system has been recently launched. Linked to the web GIS information system SAGIS (www.salzburg.gv.at). Beside thematic web maps it also provides a location query tool delivering all information available in terms of a PDF report.

1.5. Disclaimer for Mockups

In several parts of this White Book, mockups will be shown of how the web platform and in specific the decision support and information tool might look like when it is finished. These mockups were mainly created to visualize the user flow on the platform and to give an idea about the planned layout. It is important to note that the layout and especially the content of the Mockups do not necessarily represent the final output. Changes will be made during the process of developing the platform and during the beta phase of the platform. The wording will change and the layout might also change during the development.



2. General structure

2.1. General structure of the web platform

The web based decision support and information tool will be part of the overall web portal that will be developed in the scope of the GeoPLASMA-CE project. Besides the decision support and information tool, it will also consist of the international expert platform that is described in D.T1.4.1 and the landing page where general information about the project will be given and which will work as an entry point for the decision support tool and the international expert platform. The web portal will be linked to the microsite of GeoPLASMA-CE during the later project implementation and will provide the technical and thematic outputs of the project. As such it will also contain the results and achievements of this project that are not directly related to the decision support and information tool or the international expert platform. The landing page will provide a map of the project area which highlights the six pilot areas of the GeoPLASMA-CE project. By clicking on a pilot area or on the label that is attached to each of these areas, the user will get to the pilot area specific, regional web based decision support and information tool with the web GIS and a traffic-light-map indicating the possibility of a geothermal installation as a starting point. Each main part of the GeoPLASMA-CE web portal is reachable at any time through links that are placed in the header that will be present on every page of the web portal. This makes it easy to reach the three main parts of the application, the landing page, the decision support and information tool and the international expert platform from every part of the web portal. A sketch of the general structure of the whole web portal can be seen in Figure 1

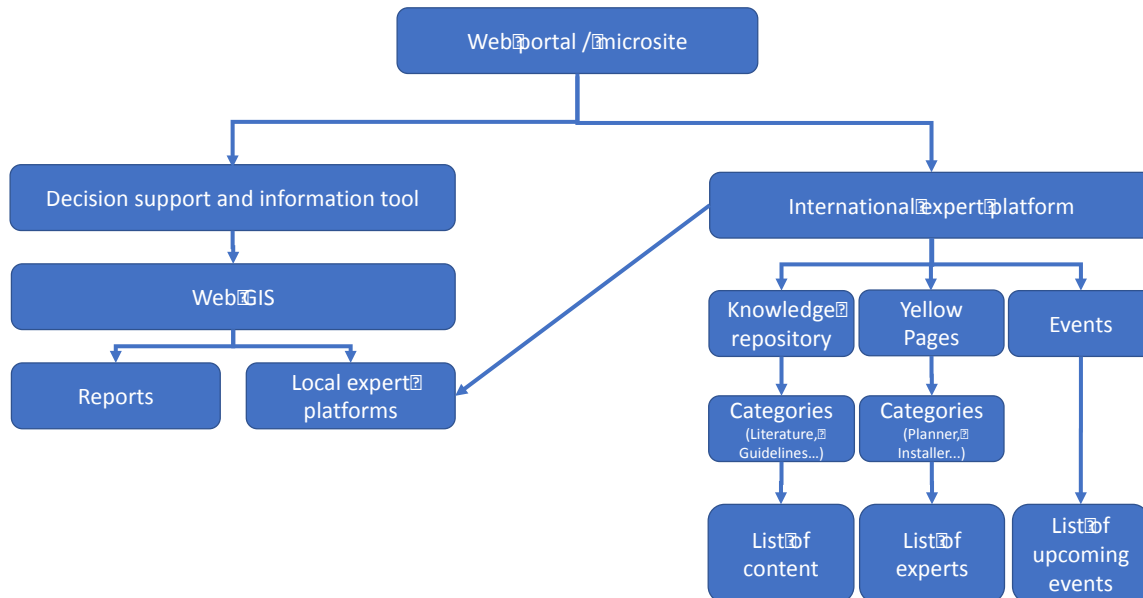


Figure 1: Proposed structure of the GeoPLASMA-CE web portal

2.2. General structure of the decision support and information tool

The decision support and information tool will be regionalized on a pilot area scale. Each pilot area will have its own sub-page comprising individual layers and features, which are taken from a joint output catalogue created in the work packages WPT1 and WPT2. However, to have a unified branding, the main features, structure and the layout will be the same in all regionalized decision support and information tools.

The entry point for each pilot area will be a regionalized landing page where some general information about the pilot area as well as explanatory notes and the results and achievements of the GeoPLASMA-CE project in this specific area will be presented. There will also be a prominent placed button to get to the actual web GIS.

In the web GIS, by default, a traffic-light-map is displayed with information about the suitability for a geothermal installation in different parts of the pilot area. The web GIS is one of the three main features of the tool. The other two are reports that are generated based on a queried location by a request of the user and the local expert platforms that are embedded into the web GIS and that get their content from the international expert platform.

Reports are accessible through location specific queries that can be created by clicking anywhere on the displayed map in the web GIS. The modal dialog that opens in this case leads the user to two available reports: a standard report and an expert report that offers more specific values from different layers at the queried location.

The header of the decision support and information tool offers the possibility to switch the pilot area or the language at any given time with two custom dropdown menus. Additionally, there will be links to the home page of the web portal and the international platform in the header (See Figure 3).



2.3. Multilanguage support

The decision support and information tool will be available in the following languages: English, Czech, German, Polish, Slovakian and Slovenian. When a user gets to the web portal, the server tries to identify the language of the user by using the “User-Agent” of the browser that is used to access the web portal. If one of the languages mentioned before can be identified, the language of the web portal will be set to this language for this user. In case none of the mentioned languages can be identified, the web portal will be set to English language.

Besides this selection based on the “User-Agent” of the browser, the user can change the language of the web portal at any time to one of the available ones. A select field with the available languages will be visible in the header at any page of the web portal. Clicking a language in this select field will reload the current page in the selected language. The website will remember the language selection for the current session on the web portal. The multi-language support of the web portal only translates the text boxes that are displayed in the user interface itself. The translation of the web portal will be a shared task between the project partners. PP10-GiGa will prepare a template with all strings that need to be translated. The project partners will be responsible to translate the given strings into their local languages.

3. Technical setup

3.1. Backend

The backend of the web platform will be based on the PHP Framework “Laravel” (<https://laravel.com/>) which will run on an Apache server platform. The backend will be responsible for all server-side tasks that are required on the web platform. It will be responsible for most of the communication between the frontend and the database, it will render the HTML for the landing page directly and it will offer APIs for the frontend to access the content of the database. The backend will also be responsible for the user authentication of the international expert platform. A detailed sketch, which shows the technical concept of the web platform, including the international expert platform and the web based decision support and information tool can be found in Figure 2.

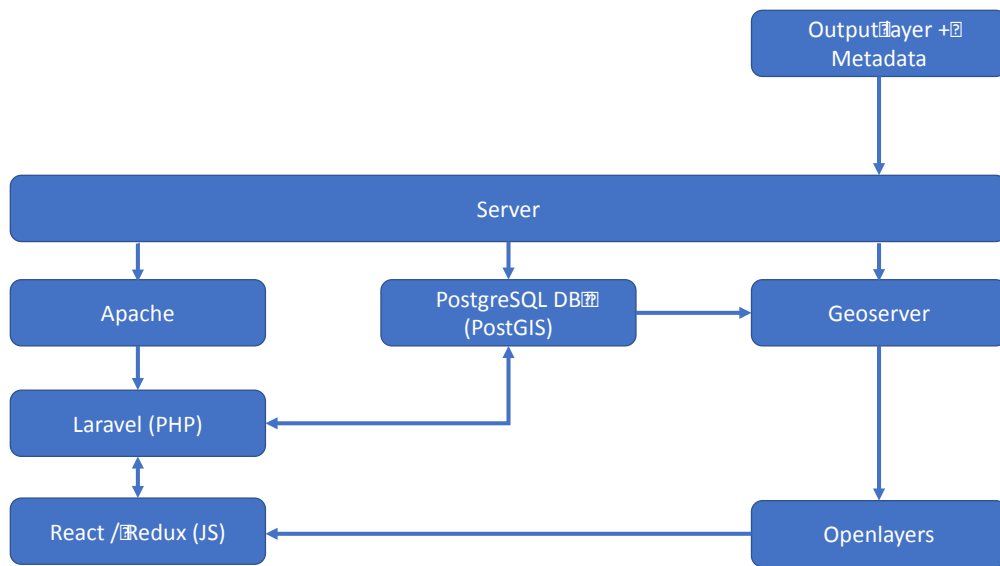


Figure 2: Technical concept of the GeoPLASMA-CE web platform

3.2. GeoServer

GeoServer is an open source server for sharing geospatial data. The GeoServer will be installed on the same server as the Laravel framework and it will be responsible for the handling of the GIS-layers that are supposed to be displayed in the web GIS. The layers that will be delivered by the project partners of GeoPLASMA-CE to LP GBA for a quality check before they will be given to PP10-GiGa, will be uploaded to the GeoServer and configured by PP10-GiGa. The raster layers will be saved on the Server in ESRI Grid Format. The GeoServer will also be responsible for handling the color maps of the layers. There will be a harmonized data classes and color maps for each parameter that will be displayed at the pilot areas of the project. Point layers that will need to handle complex requests like a radius search will be accessed through the PostGIS database. The GeoServer will deliver the GIS-layers, based on requests by OpenLayers in the Frontend, as WMS-layers that can easily be integrated into the web GIS. The WMS-layers that are delivered by GeoServer can also be integrated in a classical GIS software like ArcGIS or QGIS. Information about how this is possible will be available on the web portal.

3.3. Database

The database that will be responsible for the decision support and information tool will be a PostgreSQL database with the PostGIS extension installed. The PostGIS extension allows to make complex queries for geospatial data. An example for such a query would be a radius search for existing geothermal installations or local experts. The database will be accessed through the Laravel backend which creates its requests to the database based on the API calls from the frontend of the decision support and information tool. Only point layers, like existing installations or addresses of experts will be saved directly in the PostGIS database. Other output GIS-layers will not be saved directly in the PostGIS database, only their metadata will be saved in the database.



3.4. Frontend

The frontend in concerns of JavaScript will be based on “React” (<https://facebook.github.io/react/>) and “Redux” (<http://redux.js.org/>). The user interface of the decision support and information tool will be a single page application based on client-side rendering of React components. The state management and flow of the application will be controlled with Redux. Asynchronous actions will communicate with the APIs that are provided by the Laravel backend to gather content from the database and load it into the Redux state which will provide the data to the React components. The React app will use the react-router to make sure that every page of the international expert platform is reachable via its unique URL and can be crawled easily by search engine bots that aim to index the web platform into their search engine.

Concerning the actual GIS functionality and the handling of GIS layers, OpenLayers (<https://openlayers.org/>) will be used. OpenLayers will communicate directly with the GeoServer to load the layers that are saved on the server in WMS-Format. OpenLayers will also be responsible for the user interaction with the layers in terms of location specific queries and to extract values from the layers.

The styling of the web platform will be provided with SASS that will be compiled into CSS. The CSS will be loaded directly into the React Components to allow for easy component-focused styling rules. All JavaScript and CSS files will be combined into a single JS and a single CSS file for the deployment of the web tools. This will automatically be done through Webpack (<https://github.com/webpack/webpack>).

4. Web GIS

4.1. General structure

The entry point of the decision support tool is the web GIS showing a basic map of the selected pilot area. The default layer that is active when getting to the web GIS will be the same in all pilot areas. It will be a traffic-light map indicating the suitability of geothermal installation in the areas. This is a GIS-layer where red could mean that a geothermal installation is not feasible, yellow could mean that a further request to the authorities would be necessary and green could mean that a geothermal installation is easily possible. A mockup of the first screen can be seen in **Error! Reference source not found**. The active layer will always have a certain degree of transparency to keep the base map in the background still visible.

In the header of the web GIS, the user can switch to a different language and to a different pilot area. Each pilot area will be available in the languages of the respective area, for example Czech and German for W-Bohemia/Vogtland, and in English. Languages that are not available in a certain pilot area will not be clickable in the select field where the language can be switched. The main menu for the web GIS is the overlay on the left of the screen. On top, there is a search field for an address search. Below this field and below the headline “MAPS”, all layers that are available in the active pilot area are listed and the currently active one is indicated with a green background color. By clicking on a layer that is displayed in the list, the layer will be loaded by OpenLayers from the GeoServer and it will replace the currently active one.

There will also be a possibility to group multiple layers into a single category. For example, there will be different kind of conflict layers with one layer for each possible conflict. All conflict layers



could be grouped under the name “Conflicts” that will appear in the main menu. Clicking on the group name will open a list of available conflict layers right below the group title. By default, the first layer of the list will be loaded into the web GIS and be shown on the map after clicking on the group name. Each layer of the group can now be clicked in the main menu and it will be loaded into the web GIS.

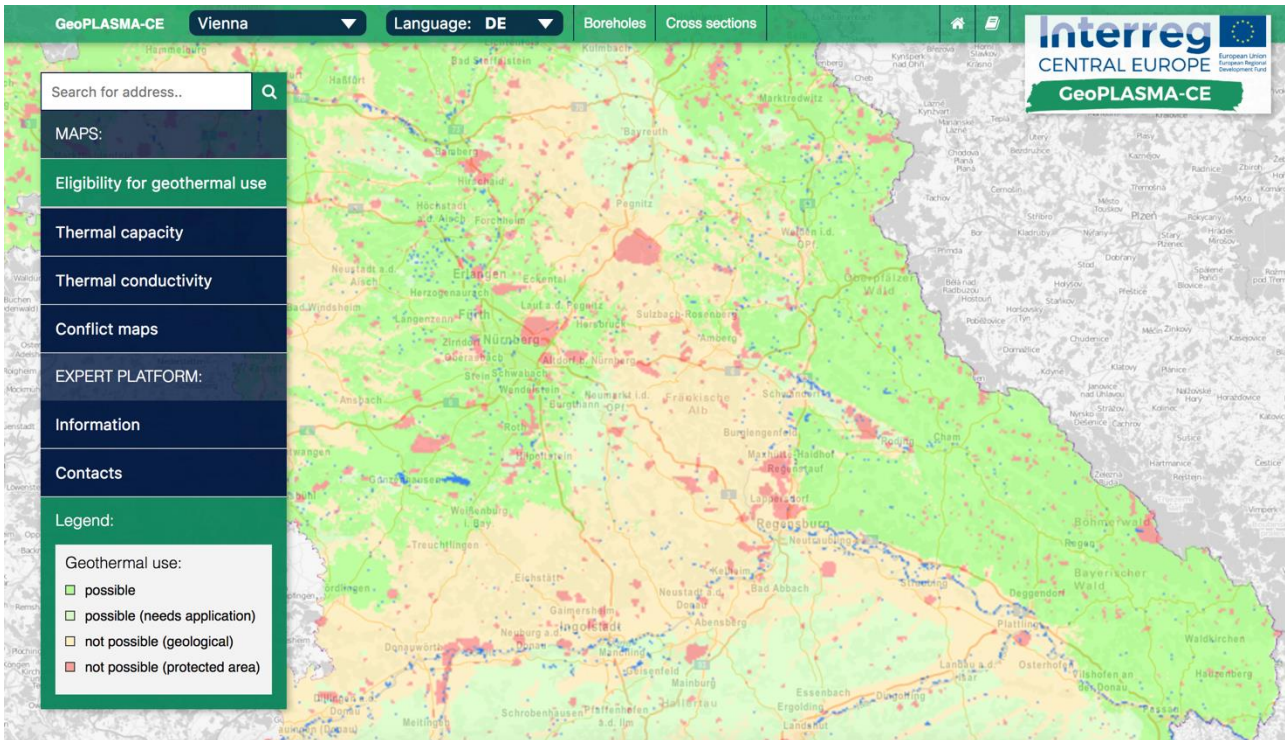


Figure 3: Mockup of the web GIS

Below the list of available layers and layer groups, the main menu will contain two links that are related to the local expert platforms. The buttons “Information” and “Contacts” will open a modal dialog with content from the international expert platform that is relevant to the active pilot area.

The bottom of the visible menu in **Error! Reference source not found.** is the legend of the currently active layer in the web GIS. It contains the name of the layer and the color-value pairs that are displayed in it. The data for the legends will come from the database. Each time a layer is changed, a request will be sent to the database to get the legend for the selected layer. The legend should be visible at every time at established screen resolutions without the need to scroll for the users, independent of the number of layers that are displayed in the main menu above the legend and the buttons for the local expert platforms. To achieve this, the list layers will be scrollable. The height of the menu will depend on the resolution of the user’s screen. On a screen with a low resolution it will be smaller overall and less layers will be displayed on first sight without scrolling. On a screen with a high resolution, more layers will be displayed without the need to scroll for the user.

To navigate the map in the web GIS, there will be two main options. The user can move the map around with the mouse or the controls in the bottom right corner of the map. Zooming in and out of the map will also be possible with the controls in the bottom right corner or the mouse. A second option to navigate to a specific location of the map is the address search. The search bar



can be seen at the very top of the main menu. The user can enter an address and click on search or press the enter button. A request will be sent to a geocoding service that includes the entered address. As a response, the coordinates of the given address will be delivered. If the request is successful, the map will center the queried location, create a marker at the location and zoom in on it. If the address can't be found, a notification will appear to inform the user about the failed request. The map will not be changed in this case.

The user will have the possibility to print the currently displayed map with the active layer by clicking a "Print map" button that will be placed in the header of the web GIS. It will generate a PDF including the map with the layer and the legend of the layer.

4.2. Integration of output GIS layers into the web GIS

The GIS-layers that will be displayed in the web GIS will be delivered to PP10-GiGa after a quality check by LP GBA. Each layer that is delivered must be delivered together with a metadata description for this layer, also including the title of the layer and information about the parameter shown. The legend will be built-up based on the joint classification scheme. All layers will be delivered in a raster format, e.g. ESRI Grid, ZMap, GeoTiff.

The delivered output layers will be integrated into the GeoServer that handles the requests from the frontend of the web GIS. The WMS-layers that are delivered by the GeoServer will be displayed with the OpenLayers library which will be responsible for displaying the layers to the user and for interacting with them in terms of location specific queries. Each call to the GeoServer will be initiated by OpenLayers which queries it and requests the specific layer that a user wants to display in the web GIS.

4.3. Displayed GIS-layers

The Layers that will be displayed in the web GIS will differ between the pilot areas. There will be quantitative and qualitative maps in all pilot areas. Quantitative maps show interpolated key data and represent a specific value. Qualitative maps show the interpretation of key values based on simplified schemes. An example for a qualitative map is the traffic-light-map that will be available in all areas and will be the default layer that is displayed when the user gets to the web GIS. The traffic-light-map will indicate the suitability of the shallow geothermal systems. A solution for people who cannot distinguish between red and green will be available to make the traffic-light-map, which normally has a color scale from red to green, accessible to everyone.

Besides these maps, there will also be point layers in all pilot areas. Point layers could, if the local data privacy rules allow it, show existing geothermal installations or local experts in a pilot area that are displayed according to the address that was entered when a profile for them was created on the international expert platform. Following is a list of all layers that will be displayed in the web GIS by each pilot area as far as it is known in the moment. This list might change during the project. Some layers will be available for different depths. In this case, the depths that will be delivered can also be seen in the list. The traffic light maps will not be listed because they will be available in all pilot areas. The table lists eight areas because the bilateral pilot areas (Vogtland / W-Bohemia and Walbrzych / Broumov) will display different layers for in each subregion.



	W-Bohemia	Vogtland
Layer	Mean value [W/m*K]	Thermal conductivity
Depths [m]	30m interval, max depth 130m	10m interval, max depth 200m
Layer	Mean value [W/m] (1800h/year)	Heat extraction
Depths [m]	30m interval, max depth 130m	10m interval, max depth 200m
Layer	Mean value [W/m] (1400h/year)	Surface temperature
Depths [m]	30m interval, max depth 130m	Surface map
Layer	Thermal conductivity [W/m*K], closed loop systems	Temperature gradient
Depths [m]	50m interval, max depth 200m	200m interval, max depth 200m
Layer	Water protection areas (curative, drinking water)	Limitation of drilling depth
Depths [m]	Surface map	Surface map
Layer	Natural reserves / protection areas	Conflict layer water protection
Depths [m]	Surface map	Surface map
Layer		Conflict layer natural reserve
Depths [m]		Surface map
Layer		Conflict layer faults
Depths [m]		Surface map
Layer		Conflict layer shallow gas leakage
Depths [m]		Surface map
Layer		Conflict layers contaminated areas
Depths [m]		Surface map

Table 1: Layers in the web GIS for the W-Bohemia / Vogtland pilot area

Vienna	
Layer	Thermal conductivity [W/m*K], closed loop systems
Depths [m]	10m interval, max depth: 200m
Layer	Thermal capacity [kW], open loop systems
Depths [m]	Uppermost aquifer

Table 2: Layers in the web GIS for the Vienna pilot area

Bratislava	
Layer	Thermal conductivity [W/m*K], closed loop systems
Depths [m]	10m interval, max depth 100m
Layer	Thermal capacity [kW], open loop systems
Depths [m]	Uppermost aquifer
Layer	Karst areas
Depths[m]	Surface map

Table 3: Layers in the web GIS for the Bratislava pilot area



Ljubljana	
Layer	Thermal conductivity [W/m*K], closed loop systems
Depths [m]	10m interval, max depth 200m
Layer	Thermal capacity [kW], open loop systems
Depths [m]	Main aquifer
Layer	Energy content [MWh/yr/ha], open loop systems
Depths [m]	Main aquifer
Layer	Confined ground water area
Depths [m]	Surface map

Table 4: Layers in the web GIS for the Ljubljana pilot area

Krakow	
Layer	Thermal conductivity
Depths [m]	30,50,70,100,130,150,170,200 (all in m)
Layer	Heat extraction
Depths [m]	30,50,70,100,130,150,170,200 (all in m)
Layer	Surface temperature
Depths [m]	Surface map
Layer	Temperature gradient
Depths [m]	30,50,70,100,130,150,170,200 (all in m)
Layer	Limitation of drilling depth
Depths [m]	Surface map
Layer	Conflict layer water protection
Depths [m]	Surface map
Layer	Conflict layer natural reserve
Depths [m]	Surface map
Layer	Conflict layer faults
Depths [m]	Surface map
Layer	Conflict layer shallow gas leakage
Depths [m]	Surface map
Layer	Conflict layers contaminated areas
Depths [m]	Surface map
Layer	Average temperature at first watertable
Depths [m]	Surface map
Layer	Mineralisation of first watertable
Depths [m]	Surface map
Layer	First watertable depth
Depths [m]	Surface map
Layer	Expected f.w.t. well productivity [m ³ /h]
Depths	Surface map



Table 5: Layers in the web GIS for the Krakow pilot area

	Walbrzych	Broumov
Layer	Mean value [W/m*K]	Mean value [W/m*K]
Depths [m]	30m interval, max depth 130m	30m interval, max depth 130m
Layer	Mean value [W/m] (1800h/year)	Mean value [W/m] (1800h/year)
Depths [m]	30m interval, max depth 130m	30m interval, max depth 130m
Layer	Mean value [W/m] (1400h/year)	Mean value [W/m] (1400h/year)
Depths [m]	30m interval, max depth 130m	30m interval, max depth 130m
Layer		Thermal conductivity [W/m*K], closed loop systems
Depths [m]		50m interval, max depth 200m
Layer		Water protection areas (curative, drinking water)
Depths [m]		Surface map
Layer		Natural reserves / protection areas
Depths [m]		Surface map

Table 6: Layers in the web GIS for the Walbrzych / Broumov pilot area

4.4. Scale of the web GIS

There will not be a unified minimum scale for the web GIS between the different pilot areas. This project includes urban pilot areas like Vienna or Ljubljana and non-urban pilot areas like Vogtland/W-Bohemia. While a lower scale makes sense in the urban areas, it is not necessary in the non-urban areas. Therefore, the minimum scale in the pilot areas will be:

- Vogtland, W-Bohemia, Broumov, Walbrzych, Bratislava: 1:50.000
- Krakow, Vienna, Ljubljana: 1:10.000

4.5. Location specific queries

The web GIS aims at making it more easy for the users to get information and a report based on a specific location. If the user clicks on a location in the map, a modal dialog will appear (Figure 4). The basic information that the dialog will offer are the coordinates of the queried location and the value of the currently active layer at this location. The indicator for the value itself, which will be displayed with a colorized square, and the value will be the same as in the legend for the currently active layer. Below the initial information on the queried location, there will be cross-references to the local expert platform. A link will be provided to the contact details of the local authority of the pilot area. More links to the local or to the international expert platform as well as an external link (e.g. to a local authority) can be provided in the modal dialog if this is desired



by the pilot areas. At the bottom of the modal dialog there will be two buttons to lead the user to the two different reports that will be available: A standard report and a more advanced report. Both reports will be based on the queried location that is shown in the modal dialog. The details of these reports are described in the appropriate chapter.

The modal dialog will also have the option to search for existing geothermal installations in a radius that can be entered by the user, given the data is provided by the pilot areas. Entering a radius in kilometer and clicking the “Show on Map” button will close the modal dialog and show the existing installations on the map in the web GIS. This feature will only be activated at those pilot areas, where existing uses are known and allowed to be displayed. The location that was queried before the radius search and the radius itself will also be displayed on the map to give the user a better overview and to make it easy to query the same location again by clicking on the highlighter for the location in the map.

Another radius search will be available for local experts. This search will work the same way as the radius search for existing geothermal installations. Entering a radius and clicking the “Show on Map” button will display the local experts inside the given radius. The data for the local experts will be derived from the international expert platform (See also Deliverable D.T.1.4.1). Every profile that was created for the “Yellow Pages” of the international expert platform will be displayed, if the given address could be geocoded. The Geocoding happens automatically when entering a profile.

The modal dialog can easily be closed by clicking on the close button in the top right corner. Clicking on another location in the map will close the opened modal dialog and open another one with the newly queried location.

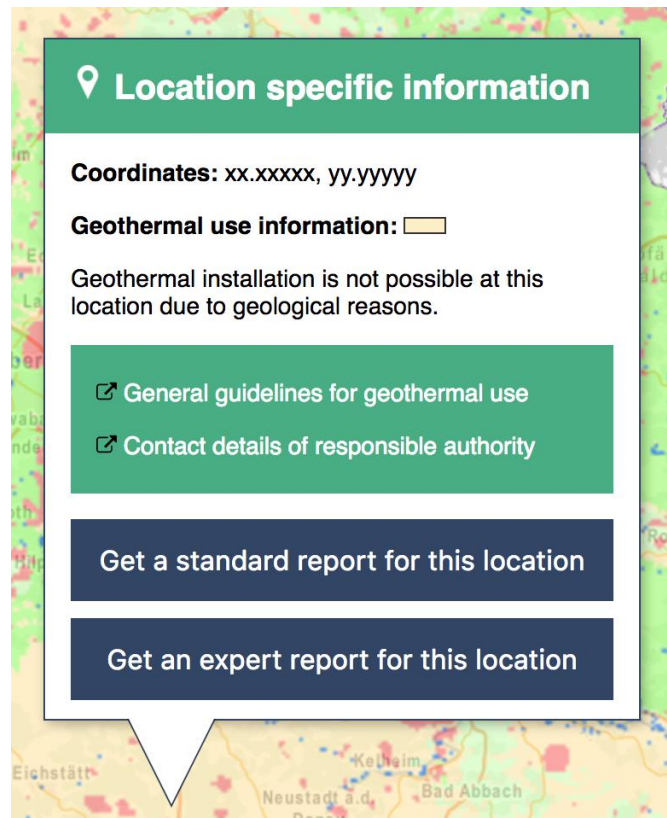


Figure 4: Mockup of the modal dialog for a location specific query

4.6. Cross sections and virtual boreholes

While the decision support and information tool will not provide an own 3D model viewer within the web platform, there will be a possibility to create virtual cross sections and virtual boreholes that will be based on the 3D models that will be created during the project.

To create a virtual cross section, a user has to click on the button “Cross section” that can be found in the header of the web GIS. Clicking this button will open a modal dialog at the top right corner of the map. A mockup of the modal dialog can be seen on Figure 5. Inside the modal dialog there will be a button “Create cross-section”. After clicking this button, the user can click on any given point in the displayed map to define the starting point of the section. A second click, on a different location, will define the next point of the section. Sections can have multiple points. Inside the modal dialog, the length of the section and the coordinates of the starting- and endpoint will be displayed. Only after clicking on the “Generate” button, the virtual cross-section will be generated. When the process is finished in the background, the user can download the virtual cross-section as an image file or as a PDF file through the modal dialog. Closing the modal dialog with a click on the “Close” button will discard any cross section that was created.

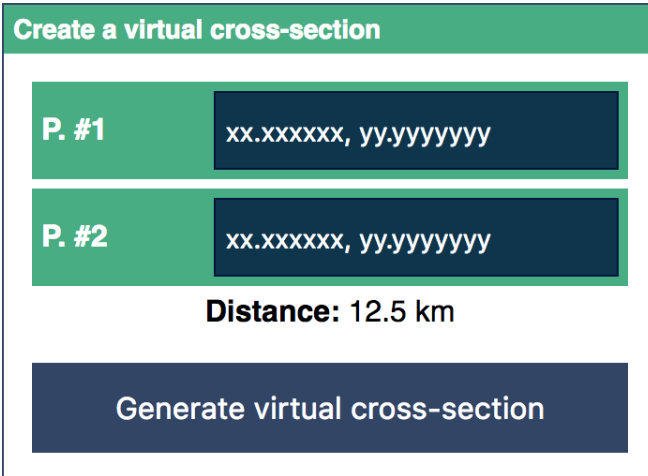


Figure 5: Mockup of the create cross section modal dialog

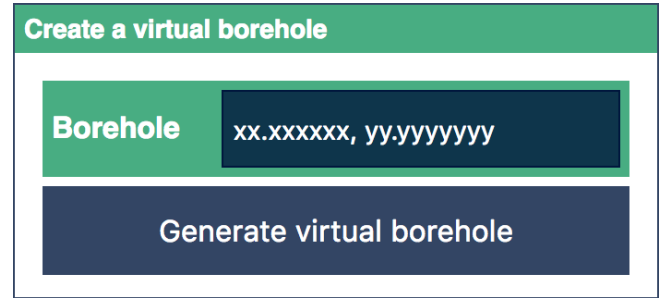


Figure 6: Mockup of the create virtual borehole dialog

Virtual boreholes will work like virtual cross-sections. Clicking the “Borehole” button in the header of the web GIS will open the according modal dialog for creating virtual boreholes. A mockup of the modal dialog can be seen on Figure 6. After clicking “Create virtual borehole” inside the modal dialog, the user can click on any point in the map of the web GIS. After this was done, the coordinates of the location are displayed in the modal dialog. Clicking “Generate” inside the dialog will now create the virtual borehole in the background. An indicator will give the user feedback when the process is finished. After the process is finished, the virtual borehole can be downloaded as an image file or PDF file. Closing the modal dialog after selecting a location on the map will discard the selection.

4.7. Basemap

The basemap of the local decision support and information tool is the map that will be displayed in the background all the time. It will provide the user with orientation for the pilot areas as it will be a classical street map. The GIS-layers that are provided by the partners will always be partially transparent to always have the basemap partially visible. The basemap of choice is OpenStreetMap (<https://www.openstreetmap.org/>). It provides a detailed street map for all local pilot areas and a unified styling. A unified style of the basemap is crucial because otherwise the users might get confused when they switch between the pilot areas and the appearance of the basemap is completely different.

4.8. Disclaimer

When the web GIS starts for the first time, a disclaimer will appear in an overlay that needs to be clicked away by the user actively before being able to use the web GIS. The disclaimer will inform that the data in the web GIS is not legally binding. It will state that for legally binding data and information the user should contact the local authorities or local planner offices.



5. Reports

5.1. Standard report

The standard report will be generated dynamically based on a queried location if the user clicks on “Get standard report” in the modal dialog that appears on a location specific query. The report will appear on a new page that is loaded when clicking the button. A mockup of the report can be seen on Figure 7. It consists of different modules that can be activated or deactivated depending on the wishes of the pilot areas.

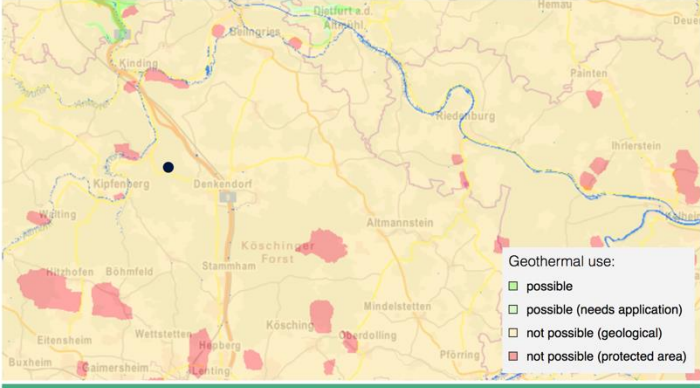
Each report starts with the name of the project and the pilot area as well as with a map that shows the queried location and its surroundings. The queried location will be marked with a marker and a legend for the currently active layer will be visible. The visible layer will be the one that was active in the web GIS when the button was clicked to generate the report. Below the map, the coordinates of the queried location will be displayed. The whole top part of the report aims at giving an overview of the location that was queried and that the report was generated for. The section that was described until this point will be identical in the reports of all pilot areas. The content that follows can differ between the pilot areas.

Below the information about the queried location, there will be a quick overview about the most important values that are available for this location. There will be information from the “Traffic-light-map” about the feasibility of a geothermal installation at the queried location and, in case a geothermal installation is feasible, information about the recommended method at this location. Next to this general information, there will be a parameter table that displays the values from all or a selection of layers at the queried location. For the standard report, not all layers will be represented with a value in the parameter table and the values that are displayed will be classified as they are for the legends. Not the exact values of a layer will appear but the class in which the value is located in.


The last part of the report are the contact details of the authority or in case of bilateral pilot areas authorities that are responsible for the pilot area in which context the report was generated. This part will be identical in all pilot areas again. The contact details will consist of the name of the responsible geological survey, the name of the responsible person within the survey (if given), an email address that can be used to get in contact with the authority and a phone number.



GeoPLASMA-CE: Location specific report - Vienna pilot area



Coordinates: xx.xxxxx, yy.yyyyy



Print as PDF

Geothermal use:

Geothermal installation is not possible at this location due to geological reasons.

Recommended method:

Geothermal use not possible

Parameter table:

Parameter	Value
Heat capacity	122 [unit]
Thermal conductivity	1.2 [unit]
Another parameter	451 [unit]

Calculate the heat extraction rate for this location:

With this tool you can calculate the heat extraction rate based on the annual heat demand that you need.
Please note that all values are estimates and not legally binding (...).

The heat extraction rate for the annual heat demand of xx is
yyy.zz

Contact details of authority:

Dr. John Doe
Department of Geology
Tel: 0123 456789
eMail: john@geology.com




Figure 7: Mockup of the location specific report

5.2. Advanced report

An advanced report for a location query can be generated by the user when the button “Get detailed report” is clicked in the modal dialog of a location specific query. The outline of the report will be the same as the standard report. However, there will be a difference with the parameter table that is different compared to the standard report and the advanced report will include a virtual borehole of the queried location. Inside the parameter table, the values will not be presented with the classification that is also used for the legends of the layers. Instead, the real values will be presented as they are saved in the layer. There will also be values from the layers that will only be displayed in the advanced report. These values cannot be found in the standard report as they are not necessary to give a first overview about a location and they might confuse a novice user. There will always be a disclaimer for the given values that explains that



the values presented are not guaranteed and that for more information, the local geological survey should be contacted.

5.3. Interactive calculations

There will be a possibility to add interactive calculations based on user inputs to the advanced reports. The pilot areas can decide if they want to give this possibility to their users or not. The calculations can be found below the parameter table and the general information on the queried location. One calculation that will be provided is the calculation of the heat extraction rate based on the user input of operational parameters like the annual heat demand or the cooling demand. Clicking on the “Calculate” button will calculate the heat extraction rate based on the input and the data from the layers that is necessary for the calculation. A mockup of how such a form could look like can be seen on Figure 7. An interactive calculation of the heat extraction in closed loop systems is planned for the pilot areas of Vienna, Bratislava and Ljubljana. The calculations will always be linked to a disclaimer which will state that the calculated values are not legally binding in any way and that for detailed information the local authorities or a local planner office should be contacted. Additional calculations may come up during the project from the pilot areas. However, it is important that the calculations will not interfere with the work of planning offices as the GeoPLASMA-CE web platform does not intend to be competition for private companies in the field of shallow geothermal energy. All calculations will be based on a combination of user input and the data that is available from the layers in the pilot area and at the specific location that was queried for the report. The interactive calculations will be a module that can be deactivated or activated for each pilot area by the technical administrator of the web portal.

5.4. PDF Export

Both reports, the standard and the advanced one, can easily be printed or downloaded as a PDF. In the report view, there will be a prominently placed button called “Download as PDF”. Clicking this button will generate a PDF of the report that is displayed on the page within the browser’s capabilities. The PDF will be optimized for printing.

5.5. Disclaimer

The reports will include a disclaimer that will state that the data in the report is not legally binding and that it includes uncertainties. It will also state that for more information and legally binding data, the local authorities or a planner office should be contacted.

6. Local expert platform

6.1. Structure of the local expert platforms

The local expert platforms of the web based decision support and information tool will be available for every pilot area. There will be two main categories of content: Knowledge repository and Contacts. Both categories can be reached through the main navigation of the web GIS. Below the available layers, there will be two buttons: “Information” and “Contacts”. The information button is the entry point for the knowledge repository of the local expert platform, while the contact



button leads to the “Yellow Pages” part of the platform. Clicking on one of these two buttons will open a modal dialog on the same page where the desired content is displayed. A mockup of the information modal dialog can be seen in Figure 8. In terms of the knowledge repository, the user has to choose a category before being able to access the content of the expert platform. Inside the lists that show the actual content of the knowledge repository or the contacts, there will be different filters to be able to see only results that are relevant for the user that is using the platform. The contacts for the Yellow Pages will be available with all details inside the local expert platforms. The content of the knowledge repository however, will only be available in a preview version with the abstract of each text. To access the full text, a user can click on a “Get full text” link that leads to the international expert platform of the GeoPLASMA-CE project with the requested text fully loaded in a new window.

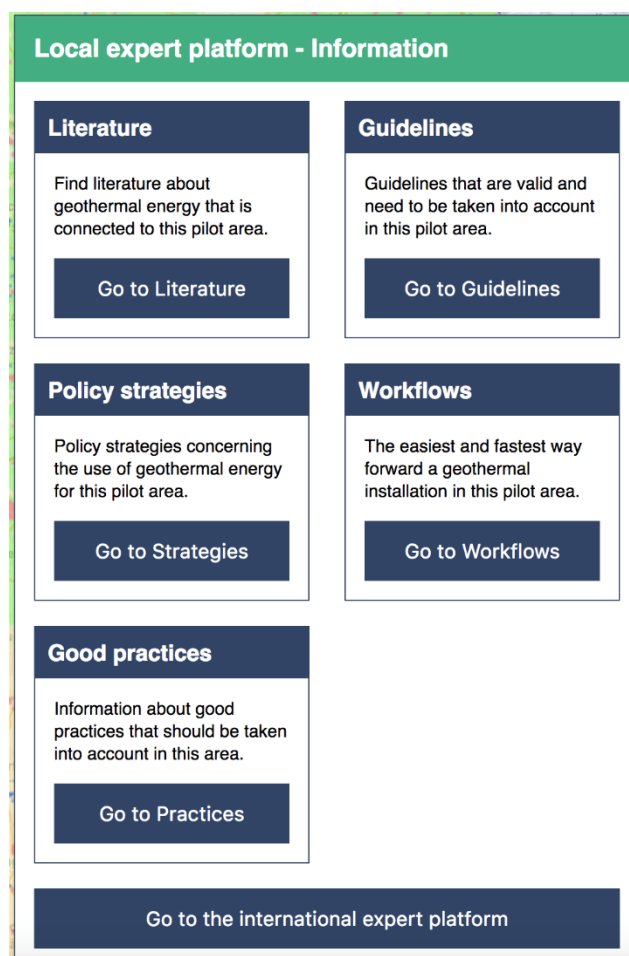


Figure 8: Mockup of the modal dialog representing the information part of the local expert platform

6.2. Content of the local expert platforms

The content of the local expert platforms will be the same as on the international expert platform that will be the other big part of the GeoPLASMA-CE web platform and that is described in Deliverable D.T1.4.1. However, to add content to the knowledge repository or the “Yellow Pages”, a user must register on the international expert platform and add the content or the profile that he or she wants to add there too. As the web GIS in which the local expert platforms will be embedded



is a regionalized tool for each pilot area, only the content of the knowledge repository that is relevant for the currently active pilot area or that has no pilot area set will be displayed.

This will also be the case for the “Yellow Pages”, where only local experts for the currently active pilot area will be shown. Inside the modal dialog for the “Yellow Pages”, there will also be a button called “Display on map”. Clicking this button will display the available contacts from the international expert platform for the active pilot area on the map of the web GIS. The coordinates for the addresses of the experts will be calculated automatically when a profile is entered for the platform. However, the user that creates the profile can correct the geocoded position by dragging the marker that highlights the result of the geocoding process. Clicking on one of the markers on the map that represents an expert will open a modal dialog where the full contact details will be listed with an option to contact the expert directly via a contact form. However, this option may not be enabled for all experts, as the choice about this possibility is up to themselves.

Additionally, inside the modal dialog that appears when clicking on “Contacts” in the main menu of the web GIS, there will be an option to enter an address and search for experts inside a radius that can be set by the user. The results of this query will be displayed as a list in the same modal dialog. However, there will also be the “Display on map” button which, if clicked, will show the results of the radius-search on the map of the web GIS.

6.3. Features of the local expert platforms

Language filter:

The local expert platforms will have a language filter available. Inside the dialog in which the content from the expert platform is shown, the user can select the language of the content that he or she wants to access. The available languages are: English, Czech, German, Polish, Slovak and Slovenian. There will also be an option called “All” that shows all content that is available, independent of the language of the content.

Keyword filter:

The “Information” part of the local expert platforms will have a keyword filter that aims to support the user in finding the information he or she is looking for as quick and easy as possible. The keyword filter can be found on the top of the modal dialog.

The keyword filter will be a custom dropdown select box. When it is clicked, a list with all available keywords appears. Each keyword has a checkbox in front of it. If a checkbox is checked and the “Filter” button inside the dropdown is clicked, the checked keyword will be set as a filter and only content that is tagged with the keyword will be displayed. Multiple keywords can be selected by checking multiple list items in the dropdown menu. If multiple items are checked, only the content that is tagged with all checked keywords will be shown. Next to the “Filter” button there will also be a “Clear” button to disable all set keywords and again show all results without filtering.

6.4. Disclaimer

All contents listed at the local expert platform will be combined to a disclaimer concerning all contents including contact details and company profiles, which have been uploaded by parties outside the project consortium. The GeoPLASMA-CE is not reliable for any contents uploaded and distributed by any persons or entities outside the project consortium. Non-compliant contents will be deleted from the web platform by the administrator of www.geoplasma-ce.eu.



7. Features that will not be realized

Some features that were mentioned in the Catalogue of Requirements (D.T1.1.2) will not be implemented for the web based decision support and information tool due to various reasons. While some features would need too much resources, other features go beyond the scope of the GeoPLASMA-CE project and are possible features for future projects in the field of shallow geothermal energy.

Public administration system

In the stakeholder survey that was base for the catalogue of requirements the features of a public administration system and the main feature itself got a very high rating meaning that it is a system which the users desire. However, after an internal survey with the responsible partners for the pilot areas, it got clear that a public administration system will not be developed in the scope of this project. A public administration system would need the full support of the responsible authorities. As the project partners are not able to decide about such a system in the name of the authorities it would be unclear if a public administration system is desired or would be used by the local governments. However, as the survey shows there is an interest in such a system and the local partners will try to talk to the responsible authorities and advertise for the need of such a system in the future beyond the scope of GeoPLASMA-CE.

Full 3D models

In the scope of the GeoPLASMA-CE project, 3D models will be created. These models can be used to generate the 2D layers that the partners responsible for a pilot area want to display in the web GIS. However, the actual 3D model or the data from it will not be accessible through the web based decision support and information tool. The focus of the web GIS will be 2D layers. If a user wants to get access to the actual 3D model data, the local project partners can be contacted and provide information on how to access this data.

3D Perspective view

A perspective 3D view will not be developed in the scope of this project. If a partner wants to display a perspective 3D view of the pilot area that they represent, it must be organized on their own. If a 3D web view is available on an external platform, a link to this platform will be available at the GeoPLASMA-CE web portal. It will not be implemented because it would take too much resources to develop such a feature in the scope of this project.

Extraction of 3D datasets

The extraction of 3D datasets in terms of datasets representing the specific values stored in a 3D model will not be available through the web portal. The full 3D models will not be displayed in the decision support and information tool. They will only be available on external sites if the local partners provide a third-party tool.

Information on energy production cost and payback time

The reports and the web GIS will not offer the possibility to calculate the cost of energy production or the payback times for a geothermal installation. These are tasks that have to be done by a planner office. The GeoPLASMA-CE web platform does not aim at being competitive to planner offices or other private companies. Thus, such calculations will not be available.

Estimate the saving of CO2 emissions



This feature will not be implemented because it would potentially also be a task of a planner office to calculate such a value. Additionally, it was rated very low in the stakeholder survey and thus in the Catalogue of Requirements.

Single datasets:

Concerning single datasets, the web GIS will offer limited support. It will not be possible to download raw data that is the base of 3D models or other calculations. The decision support and information tool will focus on the already interpreted data while the raw data is not intended to be published for everybody through the web platform. If a user has an interest in some specific raw data it is possible to contact the responsible authorities of the pilot areas and ask for the raw data directly. However, the WMS-layers will also be accessible for third parties.

8. Resources

To calculate the resources necessary to develop the decision support and information tool, it was broken down into single features that together make up the finalized platform. After an internal discussion within PP10-GiGa, estimates, based on the requirements of the features and experience from other projects about the necessary hours for each feature were created. The estimated hours of all features were added to a sum which represents the overall resources that are estimated for developing the decision support and information tool. Taken into account are already the resources necessary for writing automatic tests and writing the documentation of the code and the platform. The following table shows the calculated values for the estimated resources in hours.

Feature / Task	Hours
Geoserver / PostGIS setup	12
Layout	72
Display layers in web GIS	102
Boreholes / cross sections	240
Address search	24
Switch pilot area	6
Location specific query	18
Generating report	180
Interactive calculations	60
Contact form	6
Link to 3D viewer	1,5
Local expert platform	60
Administrator / config	150
Tests	90
Documentation	225
Setup dev environment	9
Multilanguage support	33,75
Database setup	36
Setup staging / production	45
Sum hours	1370,25



Sum days

171

Table 7: Estimation of resources for the development

9. Outlook

This White Book, following the Catalogue of Requirement (D.T1.1.2), was the second step for the implementation of the GeoPLASMA-CE web platform that will mainly consist of the international expert platform and the decision support and information tool that is described in this document. The next step is the actual development of the international expert platform and the decision support and information tool. As the development of the decision support and information tool partly relies on the outputs that will be created in different work packages of the project (WPT3 and WPT4), the main focus will be the international expert platform in the initial phase of the development. However, some tasks like setting up the development environment or the database have a link to both main tools of the GeoPLASMA-CE web platform. A lot of these tasks appear in the initial setup phase, meaning that the decision support and information tool will also benefit from the work that will be done in the initial development phase that starts right after finishing this White Book. Tasks that do not rely on the input from other work packages, like the general layout, will be approached after the first tasks of the international expert platform are accomplished.

The further development of the decision support and information tool will also rely on some test data that will be provided by the project partners to PP10-GiGa. The test data must not be in a direct connection to the actual topic of shallow geothermal energy. It will be used to create and test the workflows for loading layers into the web GIS and will not be published in any way except for layout or functional examples that will be presented internally.

At the end of August 2017, there will be an internal project workshop in Ljubljana where the status of the development until this time will be presented and discussed. However, due to the priority of the international expert platform in the beginning of the development, the web based decision support and information tool will not be shown at this workshop.