The web-oriented framework of the world geothermal production database: a business intelligence platform for wide data distribution and analysis

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European Geothermal Congress 2013
Pisa, Italy, 3-7 June 2013

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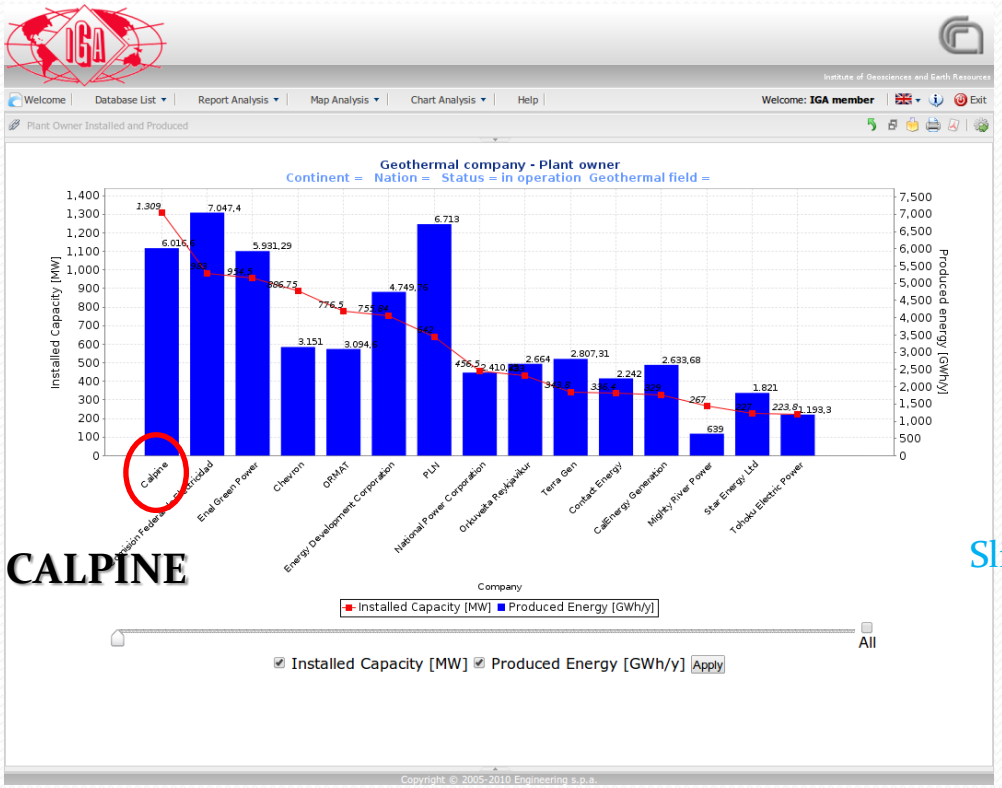
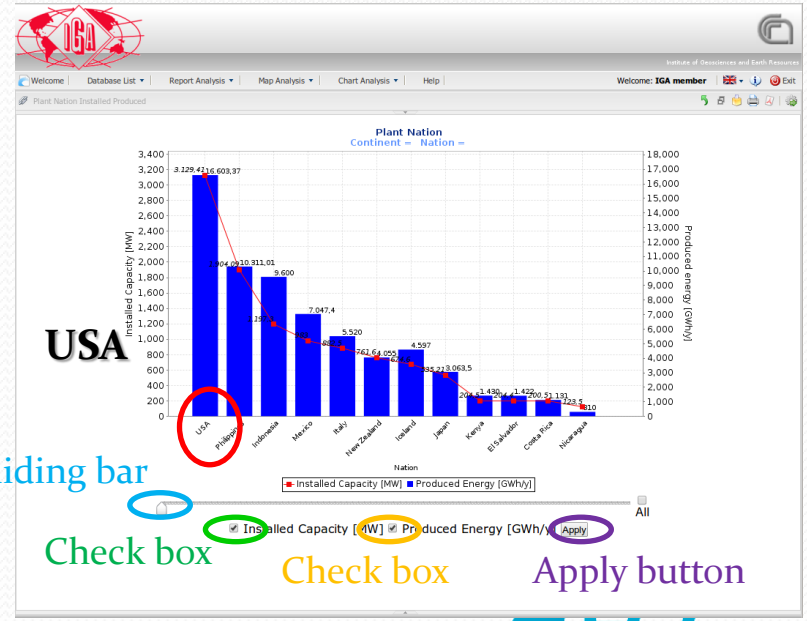
What is the company with the largest installed capacity (MW)?

...and the country?





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What do we need??

easy to use service to query, understand and analyse data

Business intelligence (BI) web platform

BI application allowed business people to acquire useful knowledge from data

SpagoBI
Open Source Business Intelligence

SpagoBI is a complete suite for development of Business Intelligence project
in an Open Source integrated environment, developed and distributed by an Italian company,
the Italian Engineering Informatica SPA

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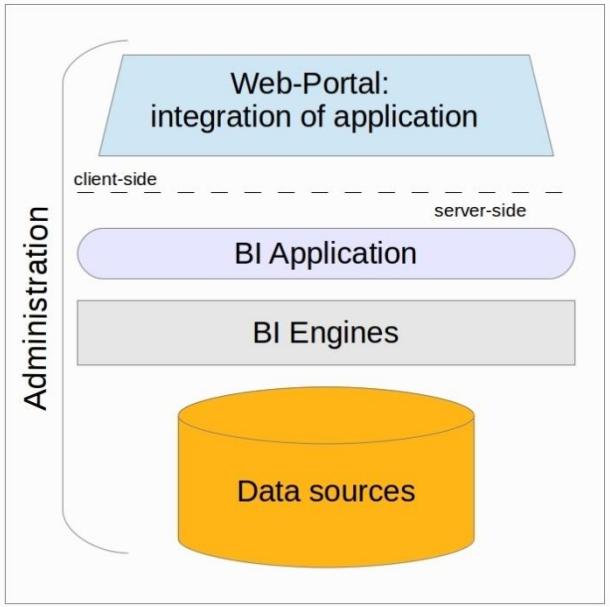
SpagoBI Architecture



database server

application server

- ✓ Metadata organization
- ✓ Static reporting
- ✓ Data mining
- ✓ Dashboard
- ✓ Charts
- ✓ Georeferenced maps

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Database content:

- ✓ IGA periodically collect geothermal data
- ✓ Every 5 years for World Geothermal Congress countries provide an update on national geothermal use (power and direct use)

http://www.geothermal-energy.org/ IGA web site

→ Geothermal energy

→ Geothermal energy database

User: visitor – Password: visitor

The GGED was developed by the IGA in cooperation with the Institute of Geoscience and Earth Resources (CNR), Italy.
Updates are conducted by the CNR following the regular content update of IGA.

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Database contents:

- ❑ Geothermal fields (location – field owner – geothermal plants)
- ❑ Geothermal plants (typology – plant owner - turbine)
- ❑ Turbine (installed and running capacity [MWe] – produced energy [GWh] – status - COD)
- ❑ Direct use of the heat (type of use – installed capacity [MWth] – annual production [TJ/year])

Typology of plants

- Binary
- Single flash
- Double flash
- Back pressure
- Dry steam
- Hybrid

Category of uses

- Individual space heating
- District heating
- Air conditioning (cooling)
- Greenhouse
- Fish farming
- Animal farming
- Agricultural drying
- Industrial process heat
- Snow melting
- Bathing and Swimming
- Geothermal heat pumps
- Other uses

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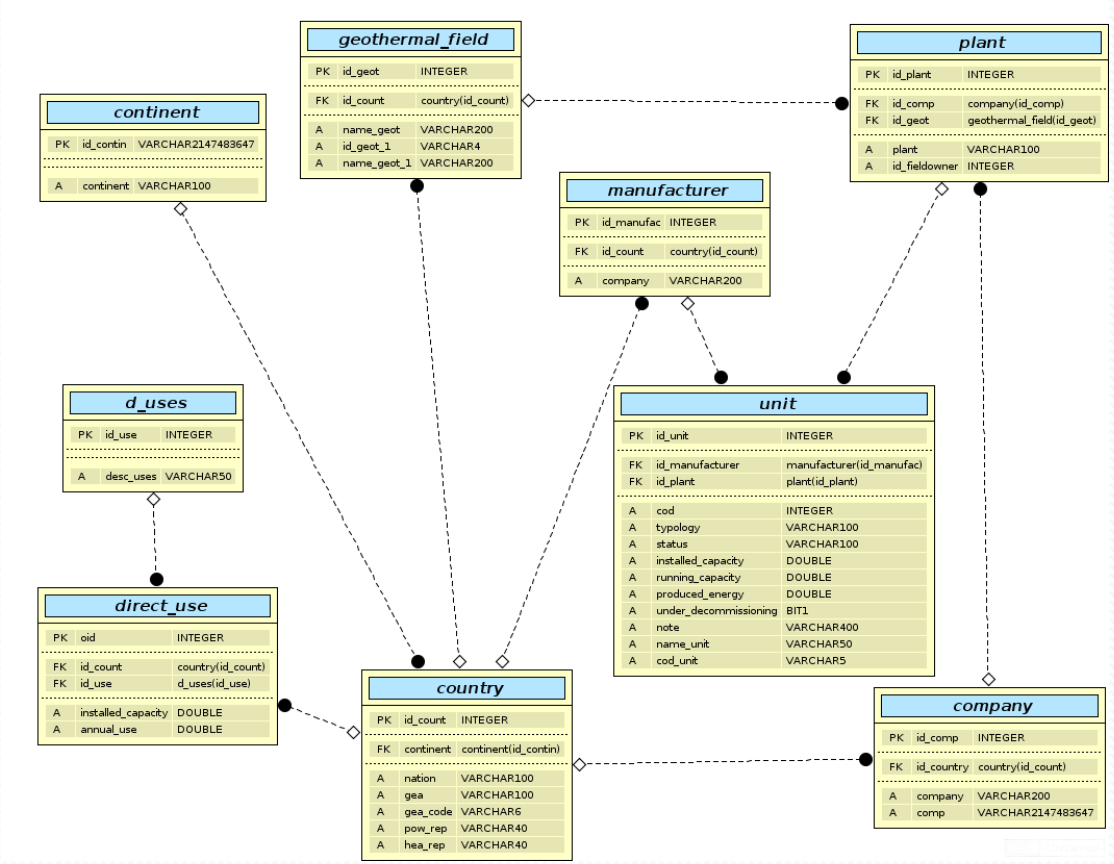
Database content:

Entity – Relation schema



Entities (with their attributes):

- Geothermal field
- Plant
- Manufacturer
- Unit
- Company
- Country
- Direct use

Relation:

- Black circle: M
- White diamond: 1

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Database Remarks:

- The IGA database consists of 9 tables in total
- Two of them are simple vocabulary tables (continent and d_use)
- Geothermal field has spatial characteristics
- The tables contain a range of rows varying from the 25 of the 'Manufacturer' table to the 916 of the 'Unit' table
- Total rows are about 2100 rows
- The table 'Unit' is the most rich in information with its 13 descriptive fields
- The whole database is about 45 Mbytes exported in a textual intelligible format, the dump file

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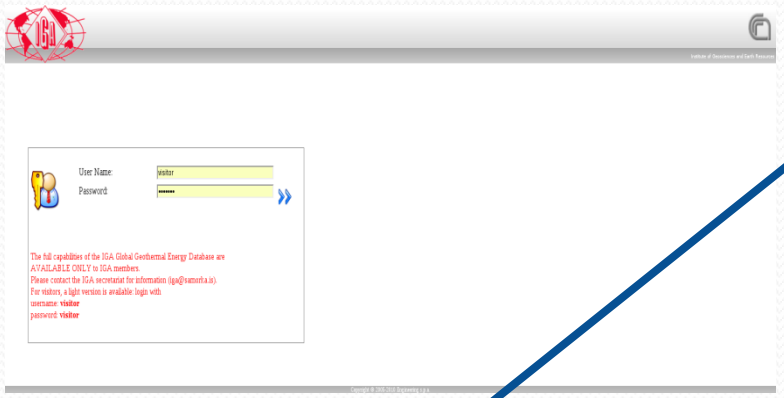
The web application allows the login for two kinds of user:

- ✓ i) igamember
- ✓ ii) visitor



Menu

- ✓ Database list (only for igamember)
- ✓ Report analysis
- ✓ Map analysis
- ✓ Chart analysis
- ✓ help

- ✓ Logged in user
- ✓ Log out

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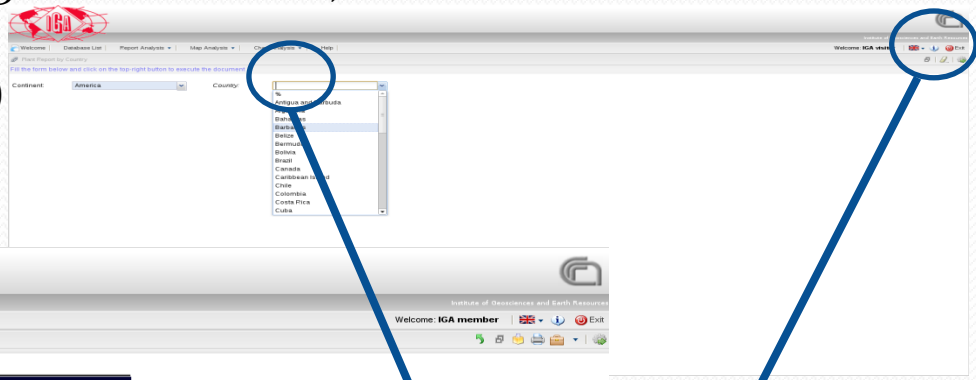
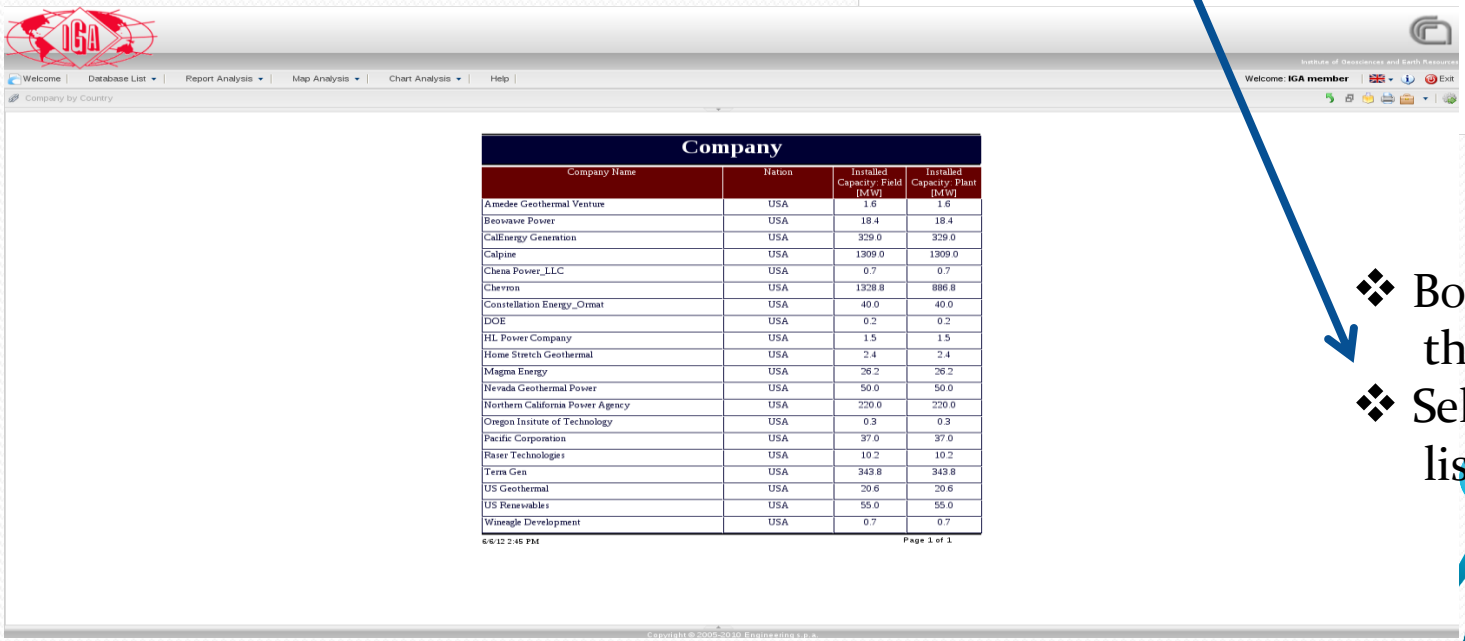
Database list (only for igamember):

- ✓ Geothermal Turbine manufacturer (and by country)
- ✓ Geothermal field (and by country)
- ✓ Geothermal companies operating field and or plant (and by country)
- ✓ Geothermal plants (and by country, by geothermal field)
- ✓ Country list according to GEA
- ✓ Direct use (and by country, by category)





Company

Company Name	Nation	Installed Capacity: Field [MW]	Installed Capacity: Plant [MW]
Amedee Geothermal Venture	USA	1.6	1.6
Beowawe Power	USA	18.4	18.4
CalEnergy Generation	USA	329.0	329.0
Calpine	USA	1309.0	1309.0
Chena Power_LLC	USA	0.7	0.7
Chevron	USA	1328.8	886.8
Constellation Energy_Ormat	USA	40.0	40.0
DOE	USA	0.2	0.2
HL Power Company	USA	1.5	1.5
Home Stretch Geothermal	USA	2.4	2.4
Magma Energy	USA	26.2	26.2
Nevada Geothermal Power	USA	50.0	50.0
Northern California Power Agency	USA	220.0	220.0
Oregon Insitute of Technology	USA	0.3	0.3
Pacific Corporation	USA	37.0	37.0
Raser Technologies	USA	10.2	10.2
Terra Gen	USA	343.8	343.8
US Geothermal	USA	20.6	20.6
US Renewables	USA	55.0	55.0
Wineagle Development	USA	0.7	0.7

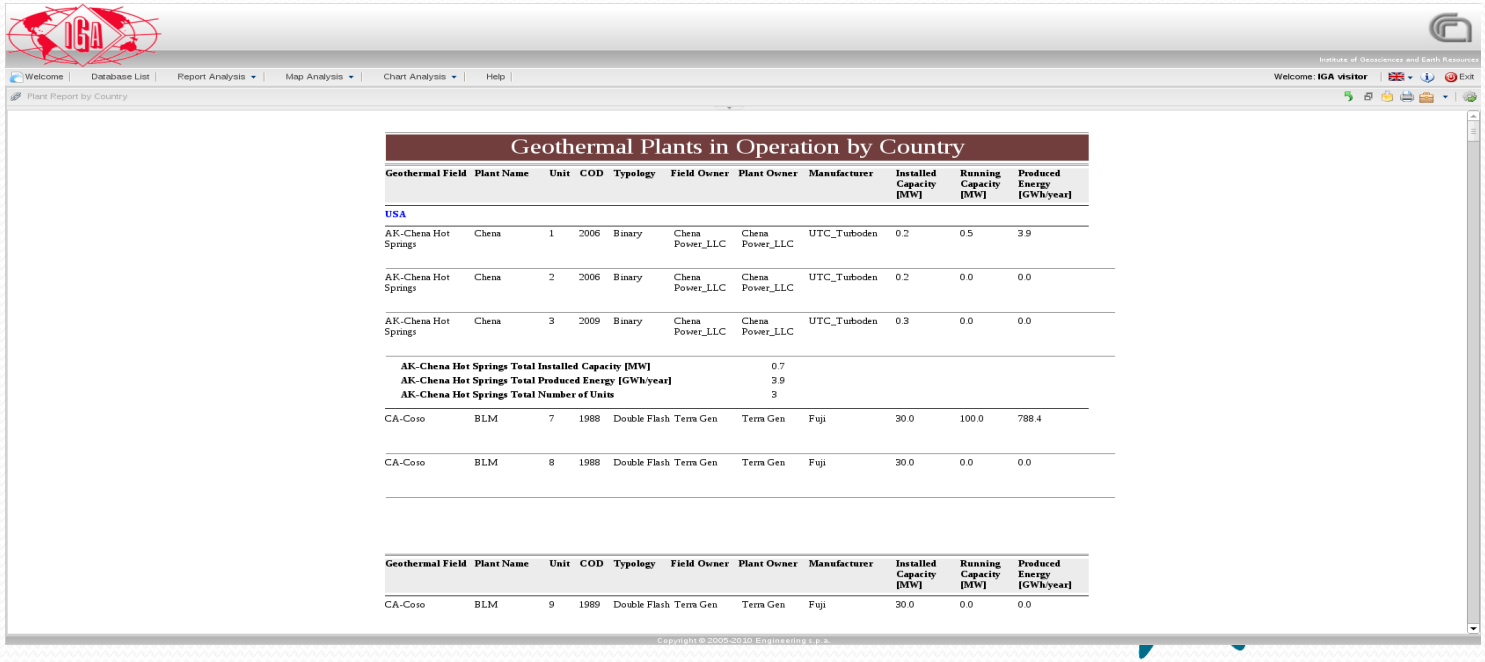
6/6/12 2:45 PM Page 1 of 1

- ❖ Botton to execute the query
- ❖ Select '%' for ALL list value

Global Geothermal Energy Database - IGA

Report analysis:

- ✓ Geothermal plants in operation by country
- ✓ Geothermal plants in operation by category
- ✓ Geothermal plants by their operative status
- ✓ Geothermal plants in operation by country and by their operative status
- ✓ Geothermal plants in operation and planned by country
- ✓ Geothermal plants by GEA code
- ✓ Direct use by country
- ✓ Direct use by category
- ✓ Direct use by GEA code



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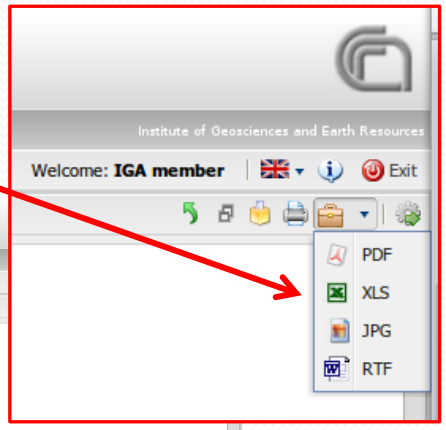
Report analysis

Export menu



Welcome | Database List | Report Analysis | Map Analysis | Chart Analysis | Help

Plant Report Future

Geothermal Field	Plant Name	Unit	COD	Typology	Status	Field Owner	Plant Owner	Manufacturer	Installed Capacity [MW]	Running Capacity [MW]
Travale-Radicondoli	Rancia	1	1986	Dry Steam	in operation	Enel Green Power	Enel Green Power	Ansaldo_Tosi	20.0	18.0
Travale-Radicondoli	Rancia 2	1	1988	Dry Steam	in operation	Enel Green Power	Enel Green Power	Ansaldo_Tosi	20.0	18.0
Travale-Radicondoli	Travale 3	1	2000	Dry Steam	in operation	Enel Green Power	Enel Green Power	Ansaldo_Tosi	20.0	19.0
Travale-Radicondoli	Travale 4	1	2002	Dry Steam	in operation	Enel Green Power	Enel Green Power	Ansaldo_Tosi	40.0	39.0
Travale-Radicondoli Total Installed Capacity [MW]							200.0			
Travale-Radicondoli Total Number of Units							8			
Italy Total Installed Capacity [MW]							922.5			
Italy Total Units							36			

Geothermal Plants in Operation and Planned by Country

Query Grand Total - Installed Capacity [MW]	922.5
Query Grand Total - Units	36

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Report title

Geothermal field subtotal

Country subtotal

All selected countries subtotal

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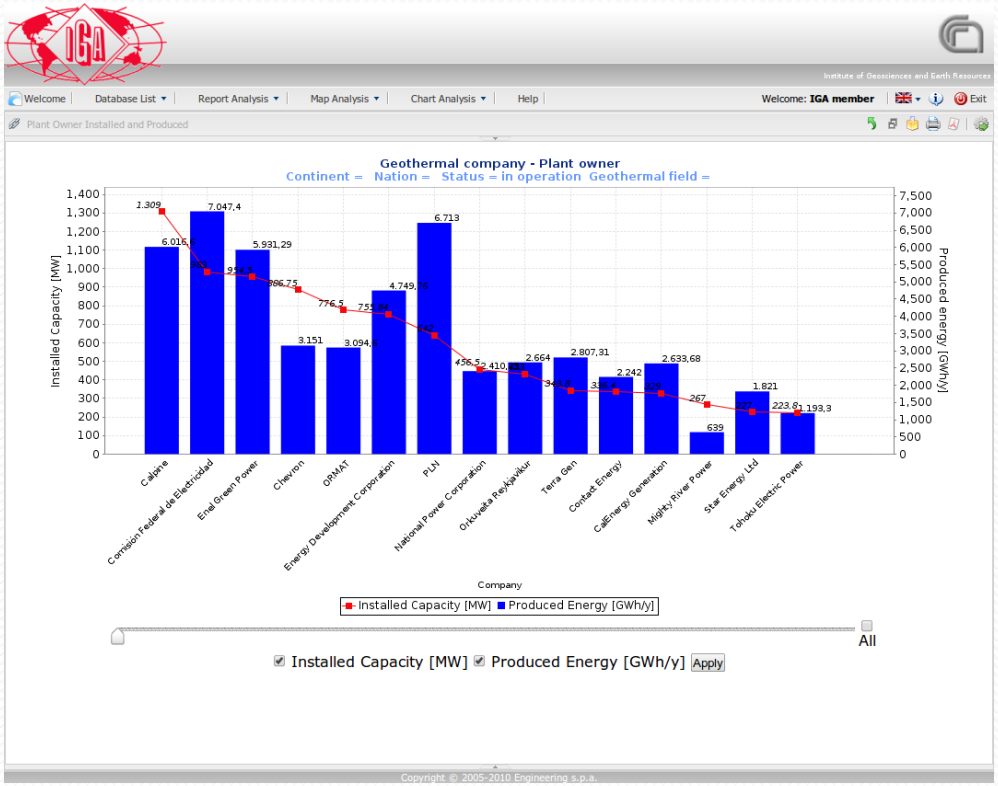
Chart analysis:

- ✓ Geothermal company – Plant owner by country, by status and by geothermal field (bar chart)
- ✓ Geothermal company – Field owner by country, by status and by geothermal field (bar chart)
- ✓ Manufacturer by country and by status (bar chart)
- ✓ Country by continent and by status(bar chart)



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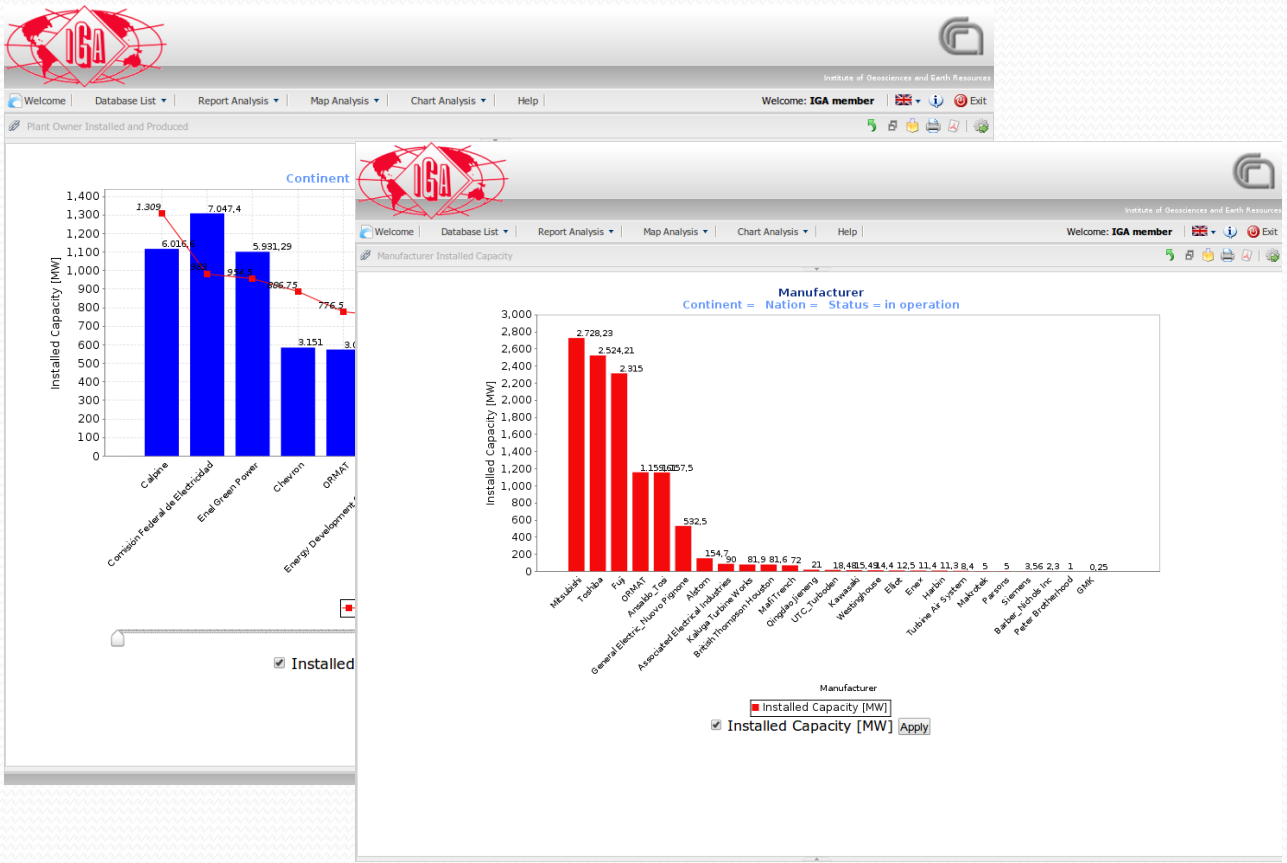

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- ✓ Manufacturer by country and by status (bar chart)
- ✓ Country by continent and by status(bar chart)

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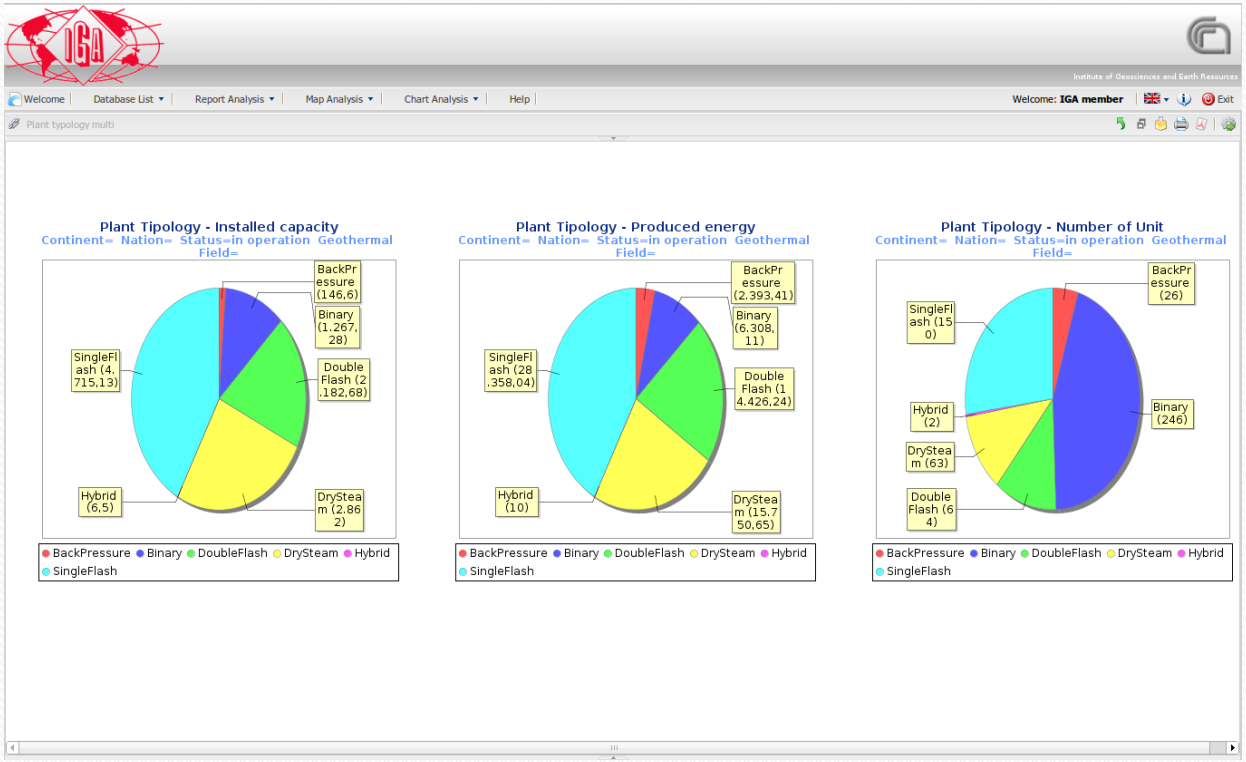
Chart analysis:

- ✓ Plant category by country, by status, by geothermal field (pie charts)
- ✓ GEA code installed capacity and produced energy by status (bar chart)
- ✓ Category of direct use by country (pie chart)



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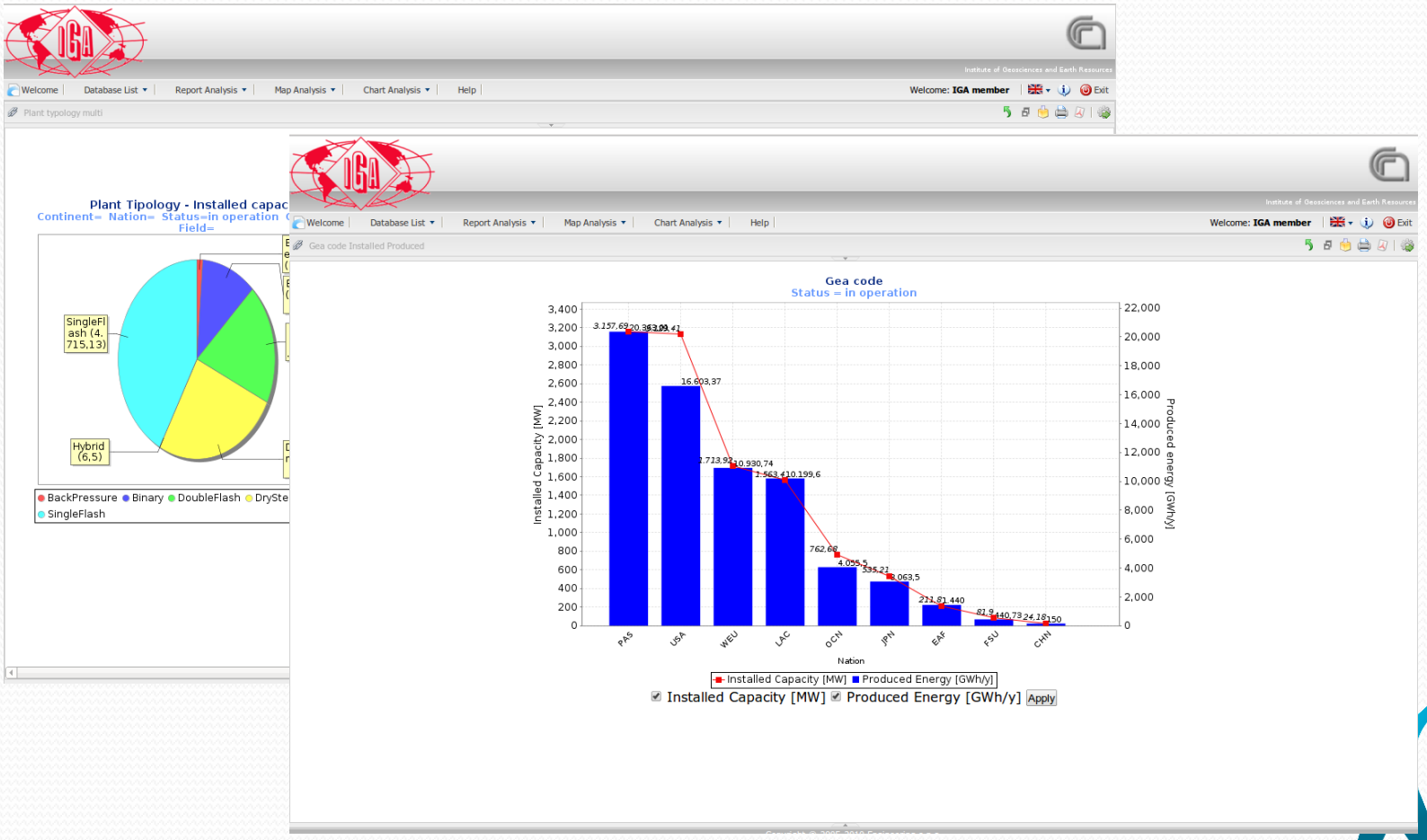

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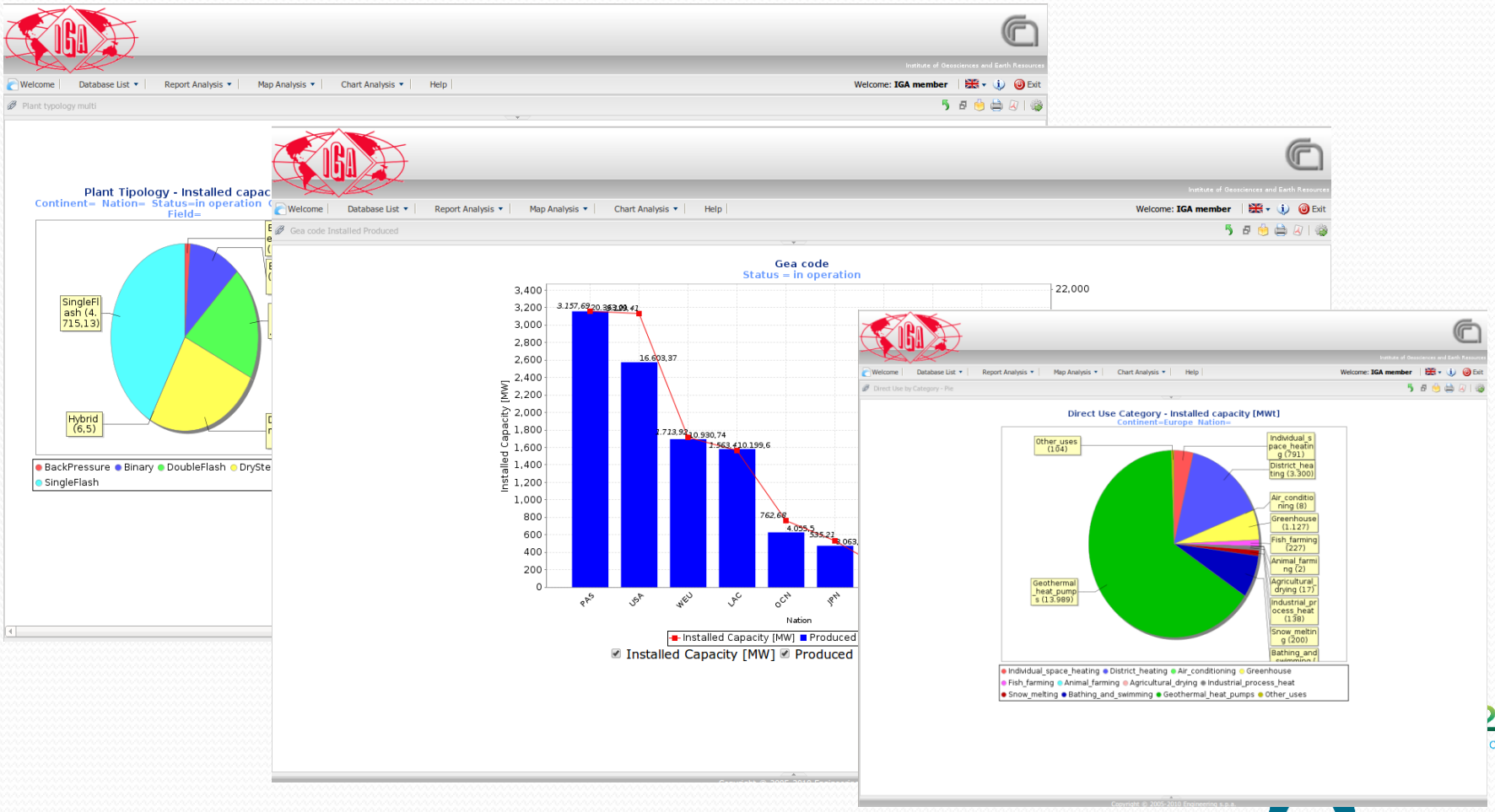

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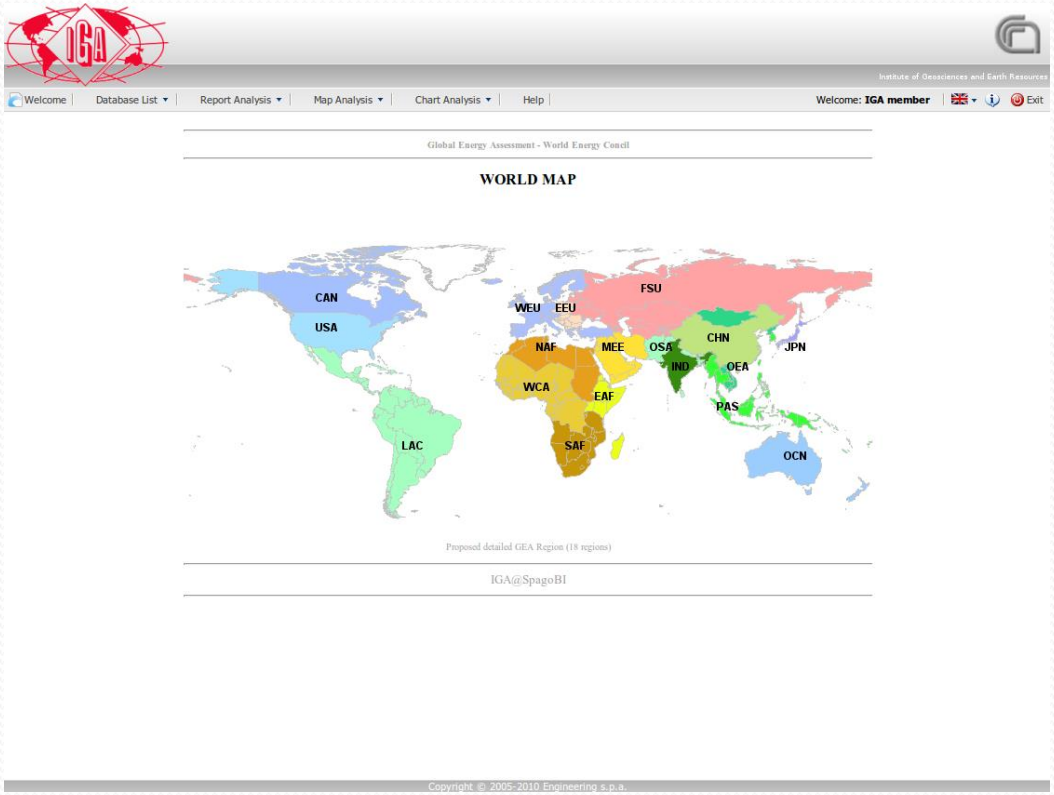
Maps analysis:

- ✓ Geothermal field – Present
- ✓ Geothermal field – Future
- ✓ Power plant by country
- ✓ Direct use by country
- ✓ **Geothermal Energy Assessment World Energy Country WORLD MAP**
- ✓ **Download Googleearth map (kml)**



Global Geothermal Energy Database - IGA

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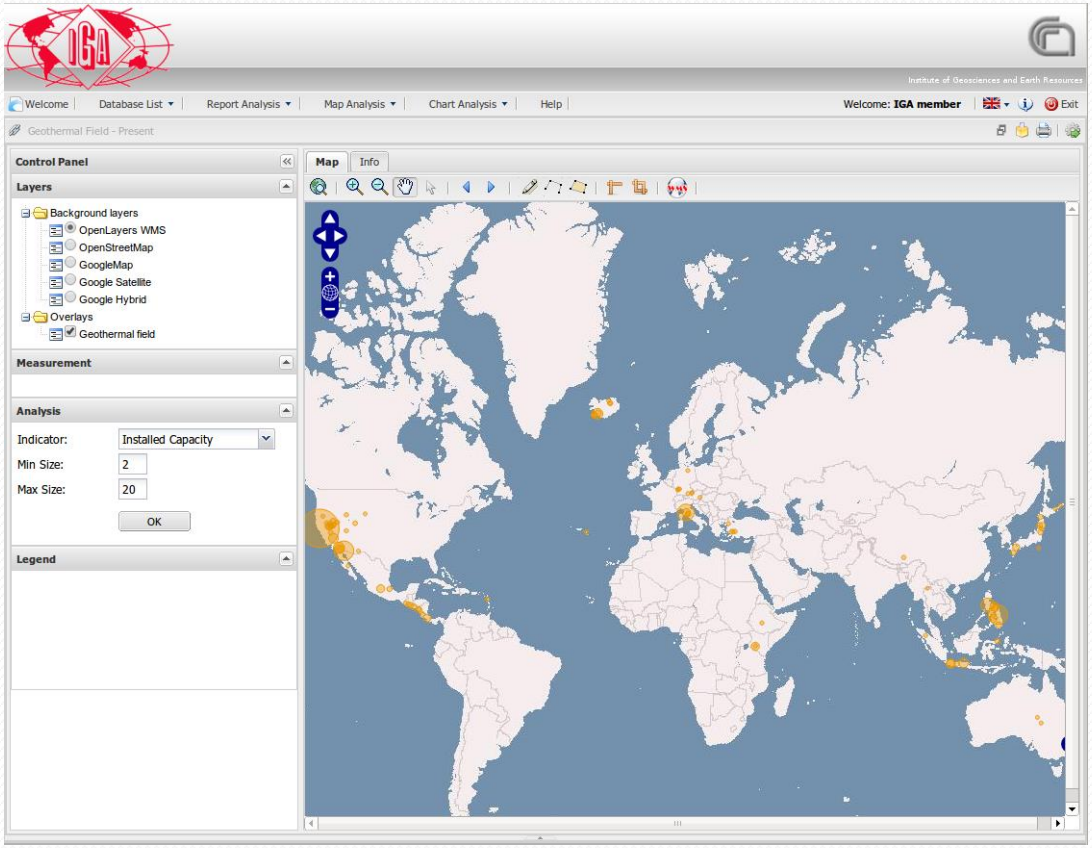

Global Geothermal Energy Database - IGA

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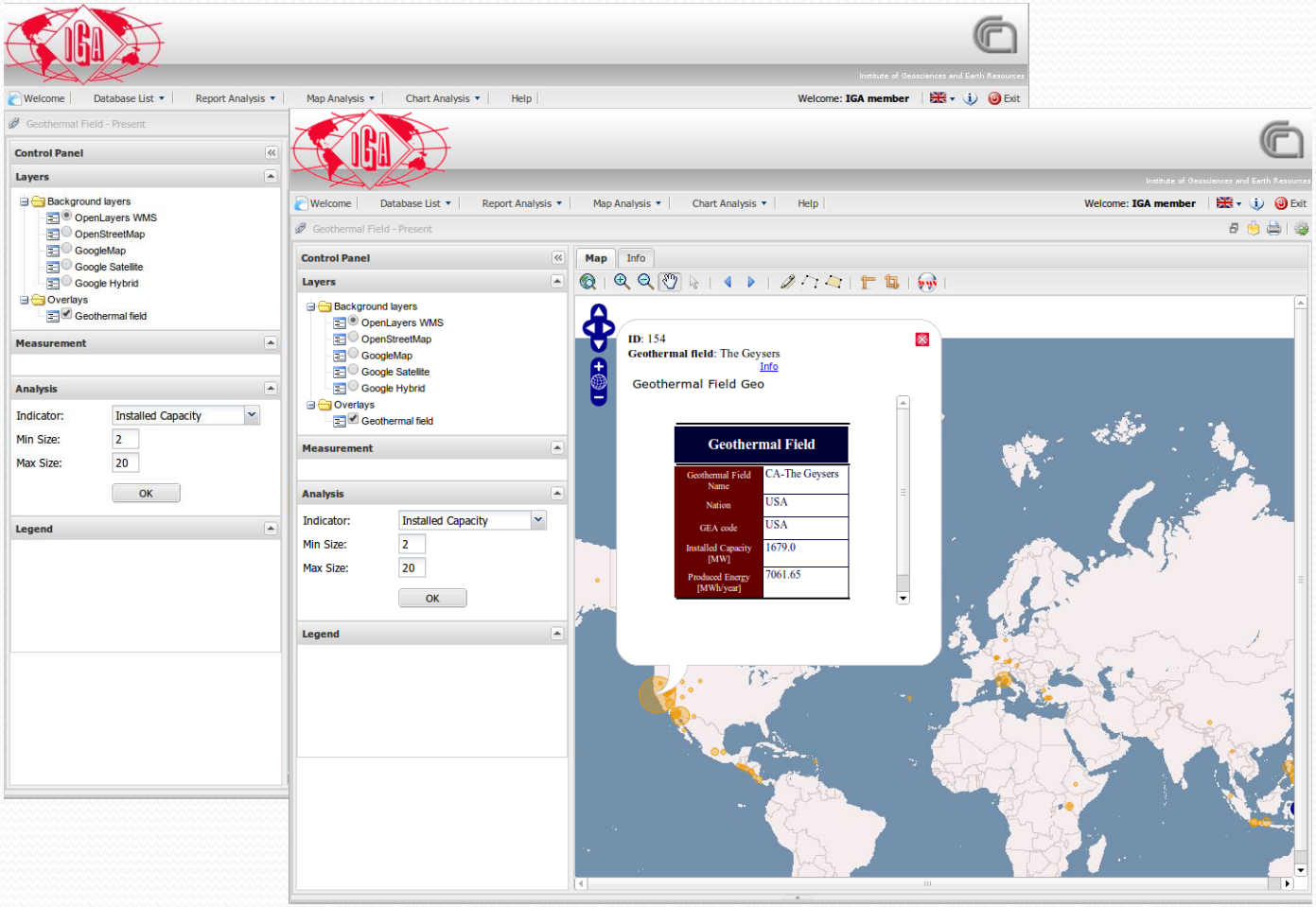

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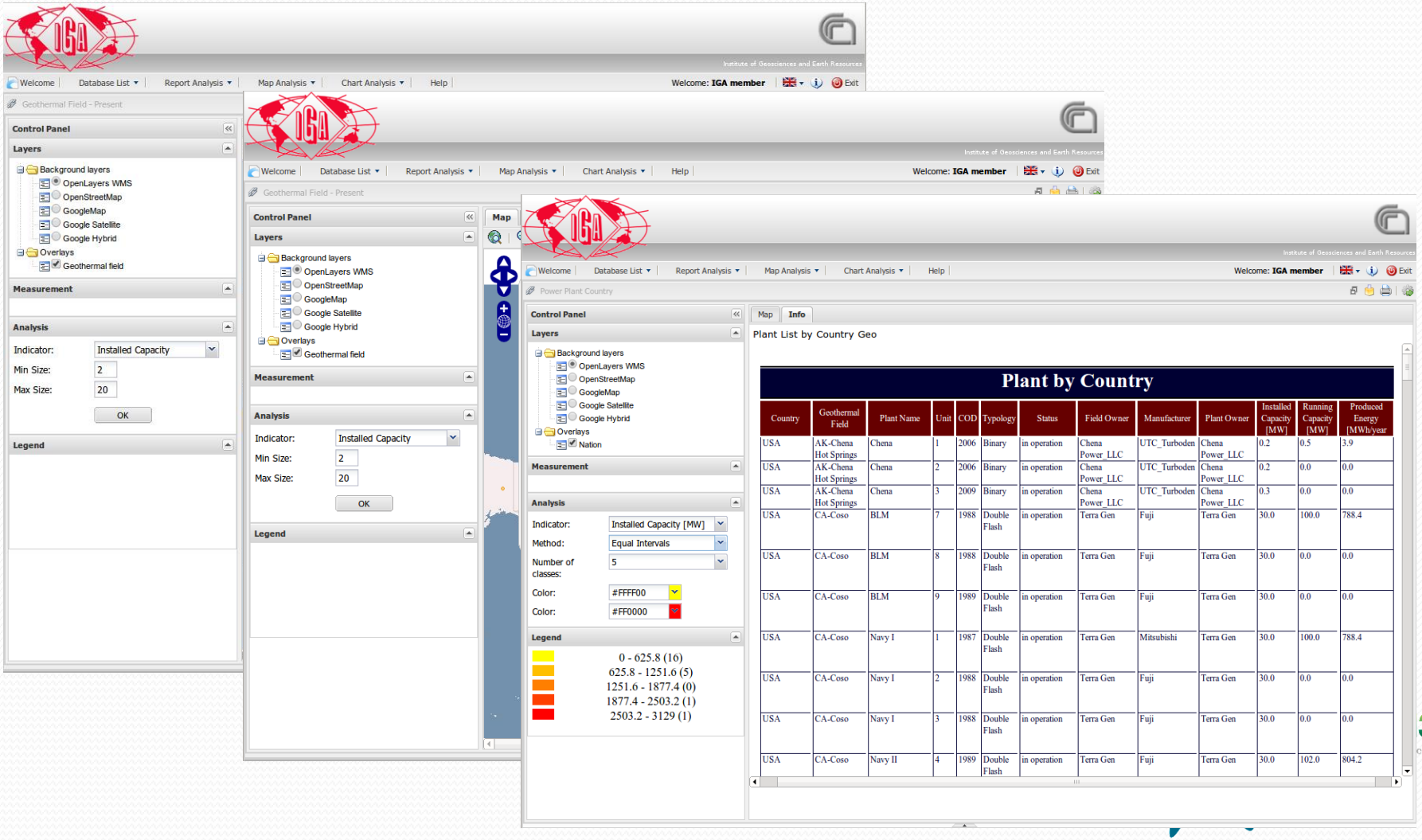
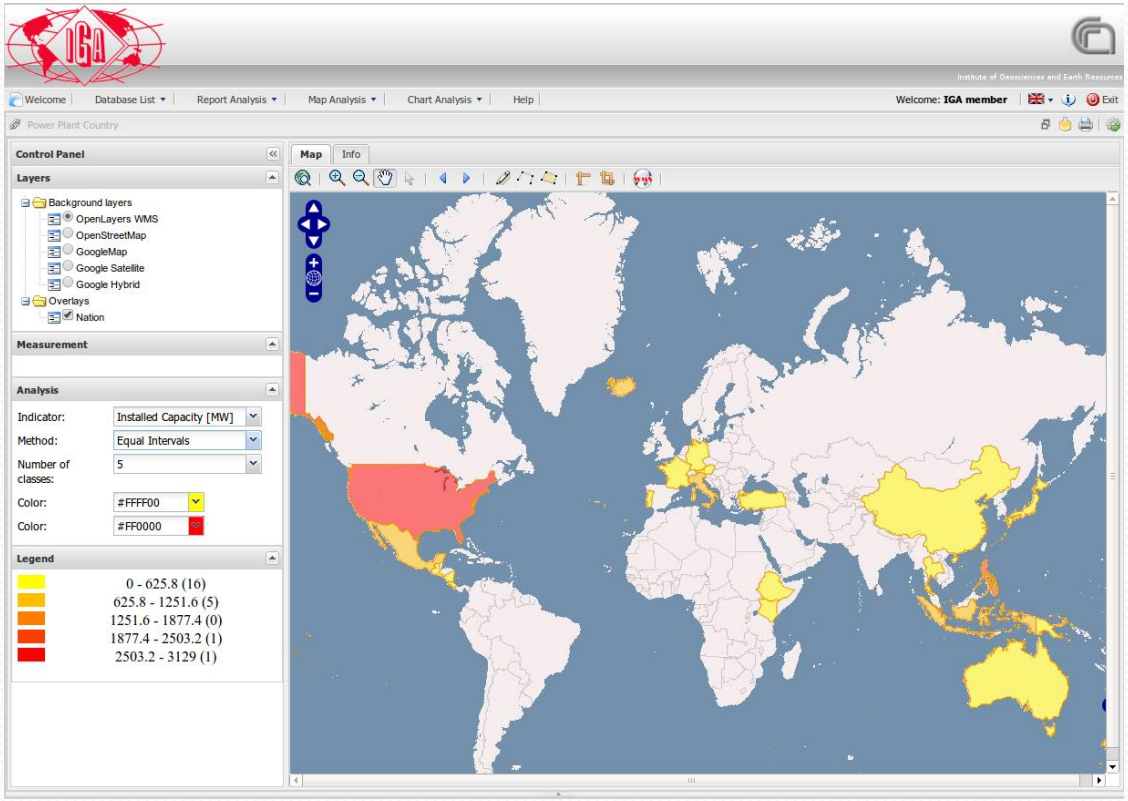


Global Geothermal Energy Database - IGA

Maps analysis:

✓ Power plant by country



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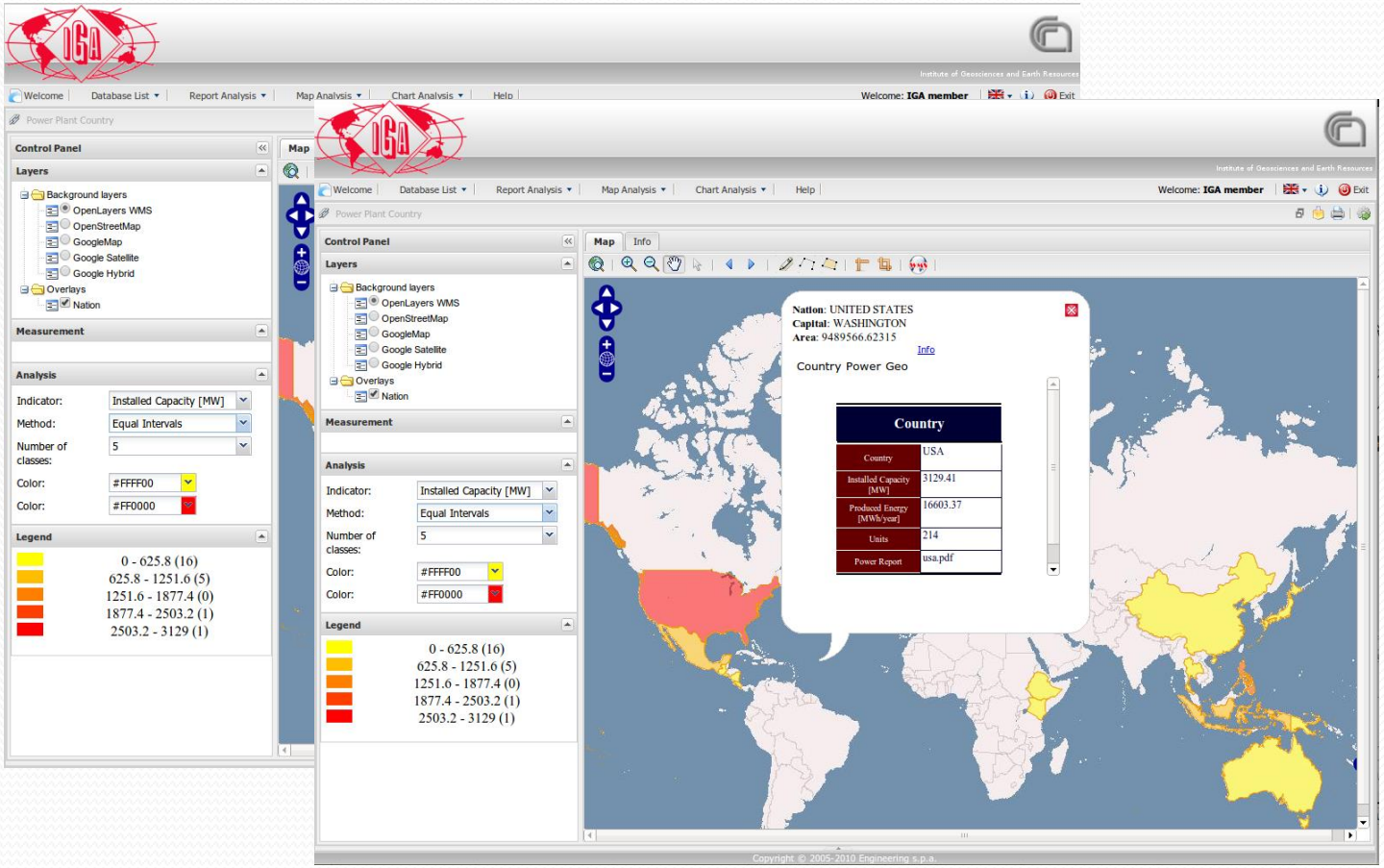

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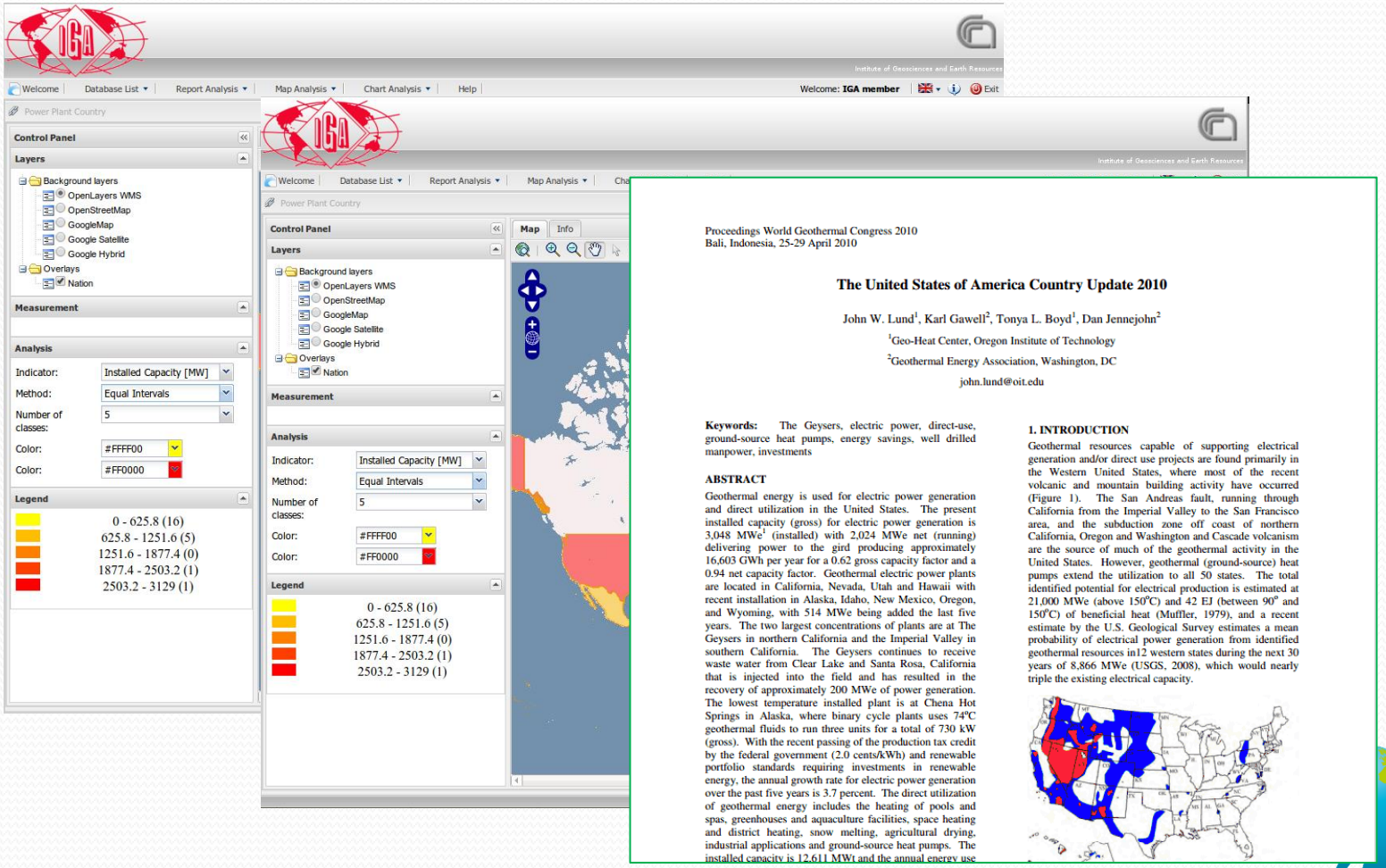

Proceedings World Geothermal Congress 2010
Bali, Indonesia, 25-29 April 2010

The United States of America Country Update 2010

John W. Lund[1], Karl Gawell[2], Tonya L. Boyd[1], Dan Jennejohn[2]
[1]Geo-Heat Center, Oregon Institute of Technology
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Keywords: The Geysers, electric power, direct-use, ground-source heat pumps, energy savings, well drilled manpower, investments

ABSTRACT

Geothermal energy is used for electric power generation and direct utilization in the United States. The present installed capacity (gross) for electric power generation is 3,048 MWe[1] (installed) with 2,024 MWe net (running) delivering power to the gird producing approximately 16,603 GWh per year for a 0.62 gross capacity factor and a 0.94 net capacity factor. Geothermal electric power plants are located in California, Nevada, Utah and Hawaii with recent installation in Alaska, Idaho, New Mexico, Oregon, and Wyoming, with 514 MWe being added the last five years. The two largest concentrations of plants are at The Geysers in northern California and the Imperial Valley in southern California. The Geysers continues to receive waste water from Clear Lake and Santa Rosa, California that is injected into the field and has resulted in the recovery of approximately 200 MWe of power generation. The lowest temperature installed plant is at Chena Hot Springs in Alaska, where binary cycle plants uses 74°C geothermal fluids to run three units for a total of 730 kW (gross). With the recent passing of the production tax credit by the federal government (2.0 cents/kWh) and renewable portfolio standards requiring investments in renewable energy, the annual growth rate for electric power generation over the past five years is 3.7 percent. The direct utilization of geothermal energy includes the heating of pools and spas, greenhouses and aquaculture facilities, space heating and district heating, snow melting, agricultural drying, industrial applications and ground-source heat pumps. The installed capacity is 12,611 MWt and the annual energy use

1. INTRODUCTION

Geothermal resources capable of supporting electrical generation and/or direct use projects are found primarily in the Western United States, where most of the recent volcanic and mountain building activity have occurred (Figure 1). The San Andreas fault, running through California from the Imperial Valley to the San Francisco area, and the subduction zone off coast of northern California, Oregon and Washington and Cascade volcanism are the source of much of the geothermal activity in the United States. However, geothermal (ground-source) heat pumps extend the utilization to all 50 states. The total identified potential for electrical production is estimated at 21,000 MWe (above 150°C) and 42 EJ (between 90° and 150°C) of beneficial heat (Muffler, 1979), and a recent estimate by the U.S. Geological Survey estimates a mean probability of electrical power generation from identified geothermal resources in12 western states during the next 30 years of 8,866 MWe (USGS, 2008), which would nearly triple the existing electrical capacity.

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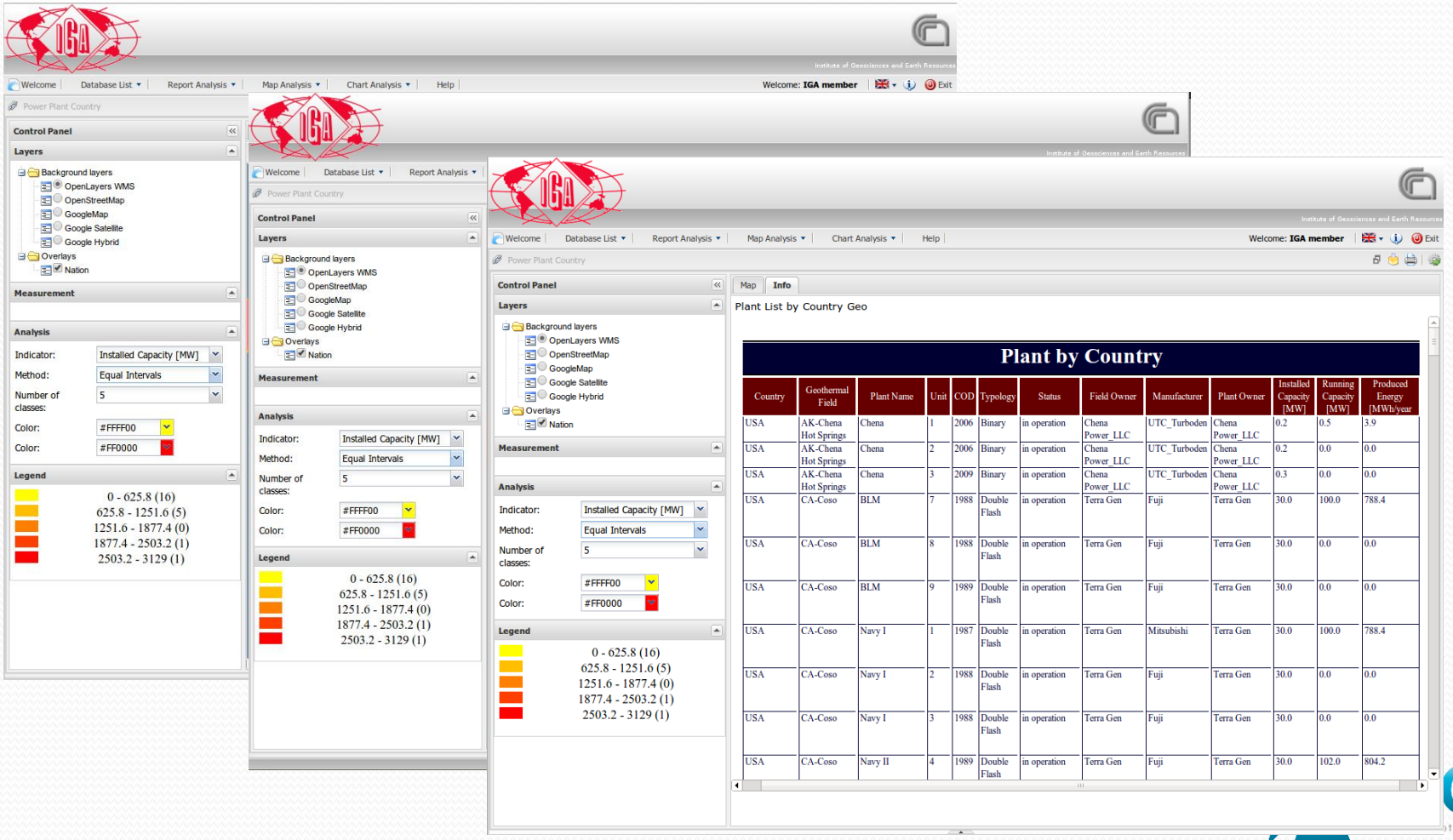
Maps analysis:

✓ Power plant by country



Country	Geothermal Field	Plant Name	Unit	COD	Typology	Status	Field Owner	Manufacturer	Plant Owner	Installed Capacity [MW]	Running Capacity [MW]	Produced Energy [MWh/year]
USA	AK-Chena Hot Springs	Chena	1	2006	Binary	in operation	Chena Power_LLC	UTC_Turboden	Chena Power_LLC	0.2	0.5	3.9
USA	AK-Chena Hot Springs	Chena	2	2006	Binary	in operation	Chena Power_LLC	UTC_Turboden	Chena Power_LLC	0.2	0.0	0.0
USA	AK-Chena Hot Springs	Chena	3	2009	Binary	in operation	Chena Power_LLC	UTC_Turboden	Chena Power_LLC	0.3	0.0	0.0
USA	CA-Coso	BLM	7	1988	Double Flash	in operation	Terra Gen	Fuji	Terra Gen	30.0	100.0	788.4
USA	CA-Coso	BLM	8	1988	Double Flash	in operation	Terra Gen	Fuji	Terra Gen	30.0	0.0	0.0
USA	CA-Coso	BLM	9	1989	Double Flash	in operation	Terra Gen	Fuji	Terra Gen	30.0	0.0	0.0
USA	CA-Coso	Navy I	1	1987	Double Flash	in operation	Terra Gen	Mitsubishi	Terra Gen	30.0	100.0	788.4
USA	CA-Coso	Navy I	2	1988	Double Flash	in operation	Terra Gen	Fuji	Terra Gen	30.0	0.0	0.0
USA	CA-Coso	Navy I	3	1988	Double Flash	in operation	Terra Gen	Fuji	Terra Gen	30.0	0.0	0.0
USA	CA-Coso	Navy II	4	1989	Double Flash	in operation	Terra Gen	Fuji	Terra Gen	30.0	102.0	804.2

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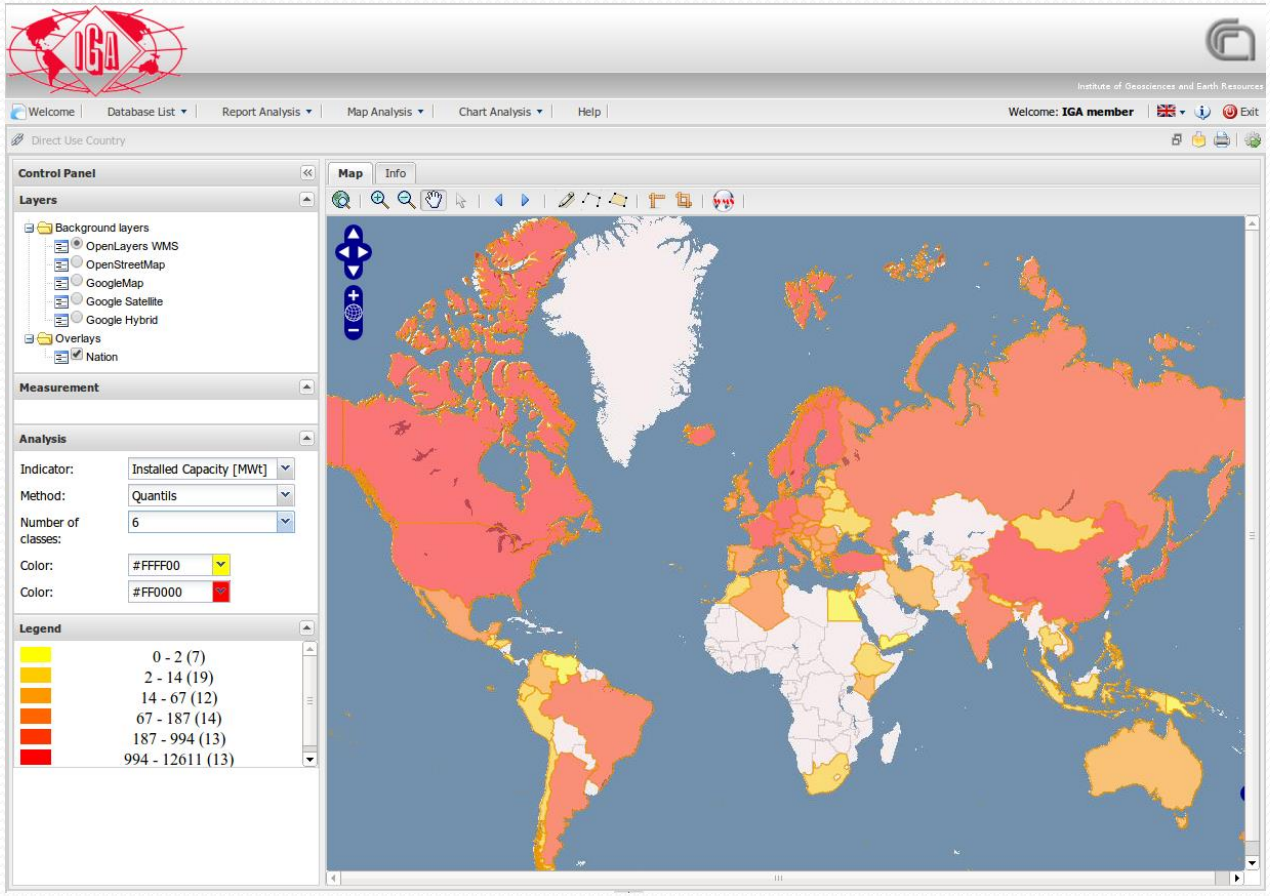
Maps analysis:

✓ Direct use by country



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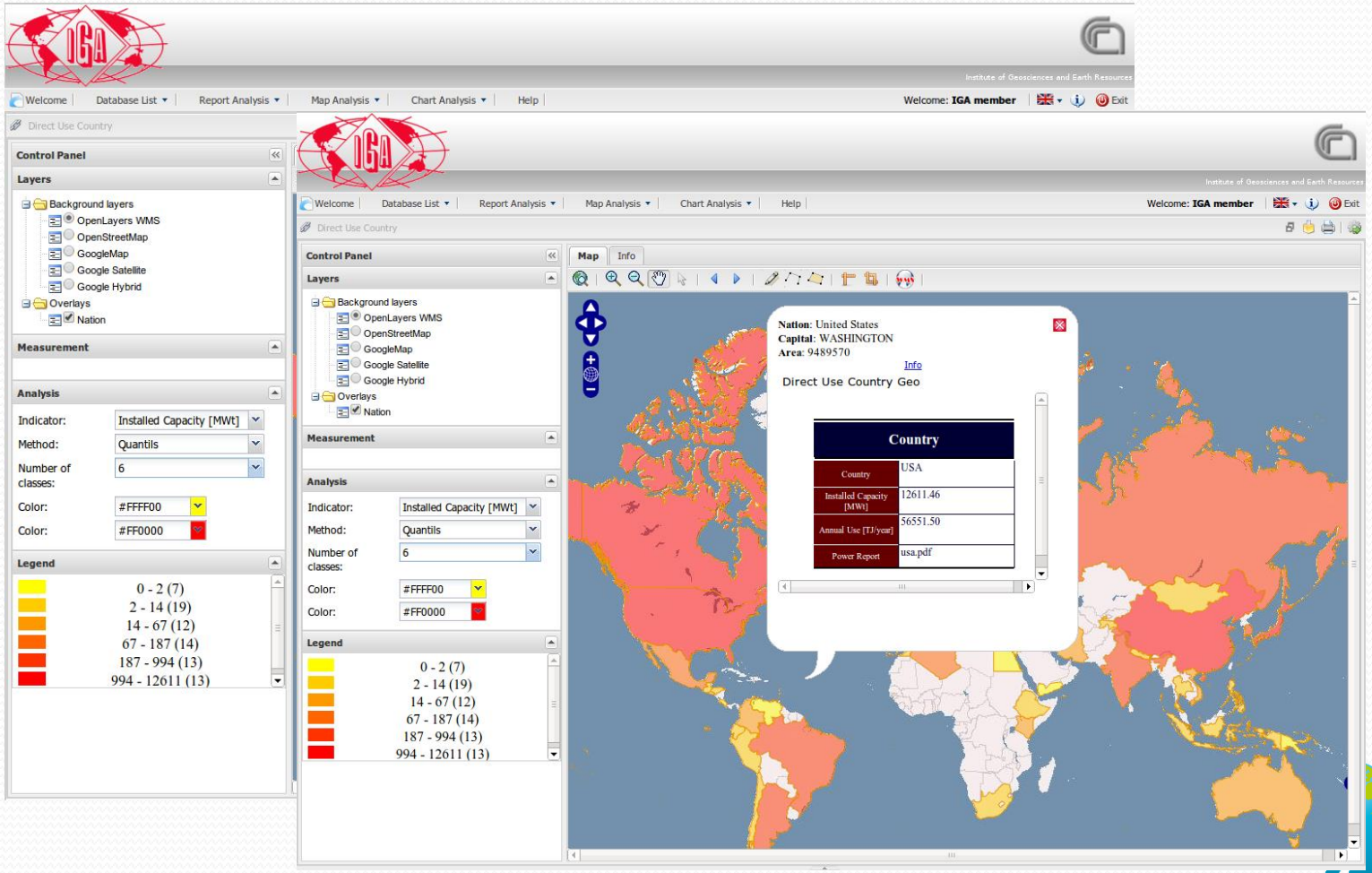

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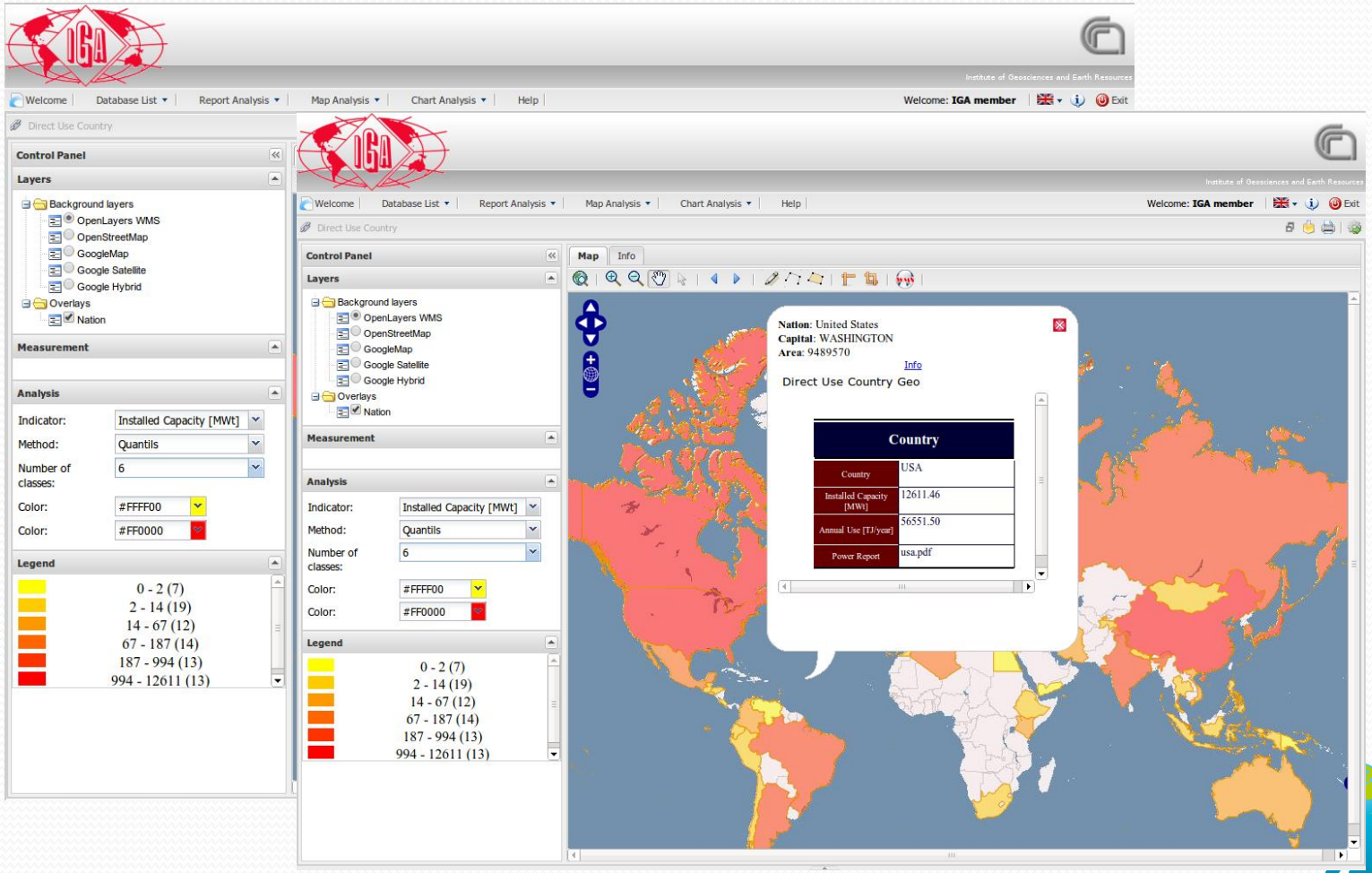

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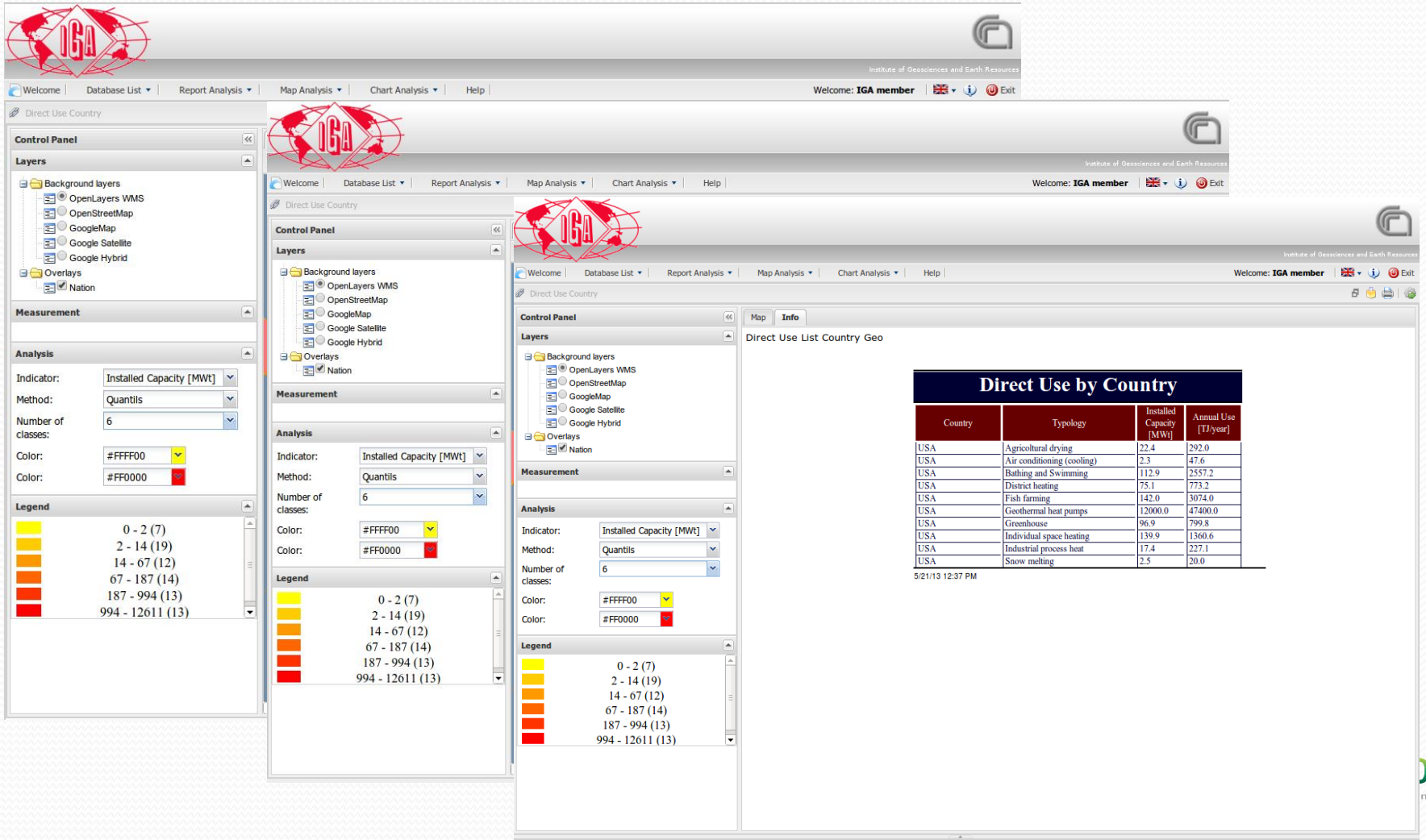

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Help:

- Introduction
- How to login
- Menu bar
- How to use *Database List* and *Report Analysis*
- How to use the *Map Analysis*
- How to use the *Chart Analysis*
- Closing remarks

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Thank you for your attention

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