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Centro Tecnológico de Eficiencia y Sostenibilidad Energética

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Galicia

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1 Modifications

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23/11/2017	V00	

2 Object

The purpose of this document is to analyze the legislation related to geothermal exploitations in Galicia, answering the following questions:

a) Geothermal energy licensing system.
b) Related regulation and administrative procedures.
c) Geothermal energy licensing authority.
d) Inventory of geothermal resources and statistics.
e) Financial incentive schemes.

3 Geothermal energy licensing system

One of the functions that the Spanish central government delegates to the autonomous communities that make up the country is the administrative management of authorizations for the exploitation of mining resources, so the granting of these permits will depend on the ministry of industry of each of the autonomous communities that make up Spain.

In the case of Galicia, as in the rest of the autonomous communities, there is no standardized procedure for the legalization of an installation related to geothermal use, even being different in each province within the autonomous community itself.

4 Related regulation and administrative procedures

As indicated above, at present, the procedure to be followed for the legalization of a geothermal installation in Galicia is not standardized, and so far the steps to be taken are different depending on if the geothermal use is done in a closed circuit or if on the contrary is made in open circuit.

4.1. Geothermal use in closed circuit

The steps to legalize a geothermal installation in closed circuit are:

1) Request the mining right authorization, which approves the completion of the corresponding geothermal surveys, and in which the following documentation is required:
    a. In the case of natural persons applicants, a copy of the national identification document, only in case of not authorizing their consultation.
    b. In the case of acting by means of a representative, a copy of the national identification document, only in case of not authorizing your inquiry.
    c. Report that includes the project of exploitation, investigation or exploration of projects of mining facilities and productive processes.
    d. Feasibility and solvency report, certifying that the applicant meets the required requirements, especially their economic and technical solvency, in accordance with the provisions of article 17 of Law 3/2008, May 23, on the management of mining Galicia.
    e. In the event that the right is subject to environmental assessment, the corresponding document according to Law 21/2013, dated December 9.
    f. Occupational health and safety plan.
    g. Restoration plan for the space affected by mining activities.
    h. Cessation plan for mining activities.
    i. Execution calendar and budget.
    j. Blueprints.
    k. Annexes.
    l. Municipal certificate on the urban situation of the place where the exploitation is to be carried out.
    m. Other documentation and information accrediting the fulfillment of requirements established in the sectoral legislation of application.
    n. Non-technical summary of all documentation, to facilitate public information.
    o. In the case of requests for mining rights, section A), documentation that proves or right of use when the mining deposit is in land of private property or qualifying title when it is in lands of public property.

    The authorization request and all the corresponding required documents will be sent to the General Directorate of Industry, Energy and Mines of the Xunta de Galicia.

The maximum term of the resolution of the request is 18 months, with the sense of negative administrative silence.

2) If the objective of geothermal use is the heating/cooling of a building through a geothermal heat pump and prior authorization for the realization of geothermal soundings, it will also be necessary to register the installation in the register of thermal installations in buildings, where the necessary documentation for the registration is the following:
    a. Installations of thermal power greater than 70 kW, must present the following documents once the installation works have been completed and the corresponding tests have been carried out:
        - Application for registration, according to Annex I of this order.
        - Installation project.
        - Certificate of the installation signed by the authorized installer and the installation director, endorsed by the corresponding official college and accompanied by the results sheets of the tests carried out according to article 22 of the regulation, according to annex II of this order.
        - In case the installation is composed of a set of thermal installations, as many certificates of individual installations as there are thermal generators exist, according to Annex V of this order.
        - Initial inspection certificate with the qualification of acceptable, when mandatory.
        - Fireplace certificate.
        - Maintenance contract with authorized maintenance company.
        - Proof of payment of fees.
    b. The installations of thermal power between 5 and 70 kW, must present the following documents once the installation works have been completed and the corresponding tests have been carried out:
        - Registration request, according to Annex I of this order.
        - Certificate of the installation signed by the authorized installer, stamped by the authorized company and accompanied by the results sheets of the tests carried out according to article 22 of the regulation, according to annex II of this order.
        - In the event that the installation is composed of a set of thermal installations, as many certificates of individual installations as there are thermal generators exist, according to Annex V of this order.
        - Technical report, according to annex III of this order.
        - Location plan.
        - Floor plan with indication of the location of the emitters and route of the pipes.
        - Scheme of principle of the installation.
        - Calculation annexes.
        - Proof of payment of fees.
    c. Documentation for the deduction for investment in heating/cooling and / or sanitary hot water facilities that use renewable energy in the home:

- Analyzed budget of the installation.
- Invoice or invoices issued by the installer enabled.
- The payment voucher (s) for the total installation cost.
- In the case of investment made by a community of owners: certificate, issued by its legal representative, of the economic contributions corresponding to each community member.

4.2. Geothermal use in open circuit

In the case of installations with geothermal use in open circuit, in addition to following the steps described in section 4.1, it will be necessary to comply with the Water Law of Galicia.

This law recognizes the owners of the farms the possibility of using the groundwater or from water springs located inside the farms. The waters can not be used in a farm other than the one in which they are born, nor exceed 7000 m^3 per year. In any case, the use of the water will be subject to the limitations established by current legislation and hydrological planning.

Those who carry out this type of use are obliged to inform the Basin Organization (Aguas de Galicia) of its existence, by requesting an authorization for private use of water by legal provision, in which the maximum resolution period is of six months with the sense of administrative silence negative. Not declaring the exploitations made could be subject to administrative sanction.

Therefore, as a second step in the legalization of a geothermal system for direct use, an authorization for private water use will have to be requested, in which the following documentation is required:

a. Identification of the applicant / representative.
b. Certificate ownership of the plot.
c. Type of recruitment.
d. No. of captures.
e. Maximum instantaneous flow (l / s).
f. Total annual volume (m^3).
g. Destination.
h. Report justifying the use (3000 m^3 / year < m^3 / year < 7000 m^3 / year).
i. Payment of administrative fees.

In the event that the consumption exceeds 7000 m^3, a different administrative procedure will be necessary to grant the use of water, in which the requested documentation is as follows:

a. Identification of the applicant / representative.
b. Certificate ownership of the plot.
c. Type of recruitment.
d. No. of captures.
e. Maximum instantaneous flow (l / s).

f. Total annual volume (m^3).
g. Destination.
h. Project subscribed by a Competent Technician.
i. Payment of administrative fees.

According to the Water Law of Galicia, direct or indirect discharges of wastewater (sanitary, process and potentially polluted) that can contaminate the public hydraulic domain[1] (sanitary, process and potentially contaminated rainwater) are subject to authorization, as well as the discharge of sewage into the terrestrial maritime public domain[2]. That is why, depending on the characteristics of the mass of water returned to the source or spring of origin after the thermal exchange of the geothermal system, it may be necessary to obtain an authorization to dump it, in which the required documentation is as follows:

a. Identification of the applicant / representative.
b. Origin of water supply (well, spring, sea, municipal, etc.).
c. Flow measurement system.
d. Medium receiver of the spill (sea, sewage, etc.).
e. Debugging system (yes / no).
f. Sludge treatment (yes / no).
g. Payment of administrative fees.
h. Technical project of the waste treatment and disposal facilities.

As in the request for authorization and concession for the use of water, the maximum resolution period is six months with a sense of negative administrative silence.

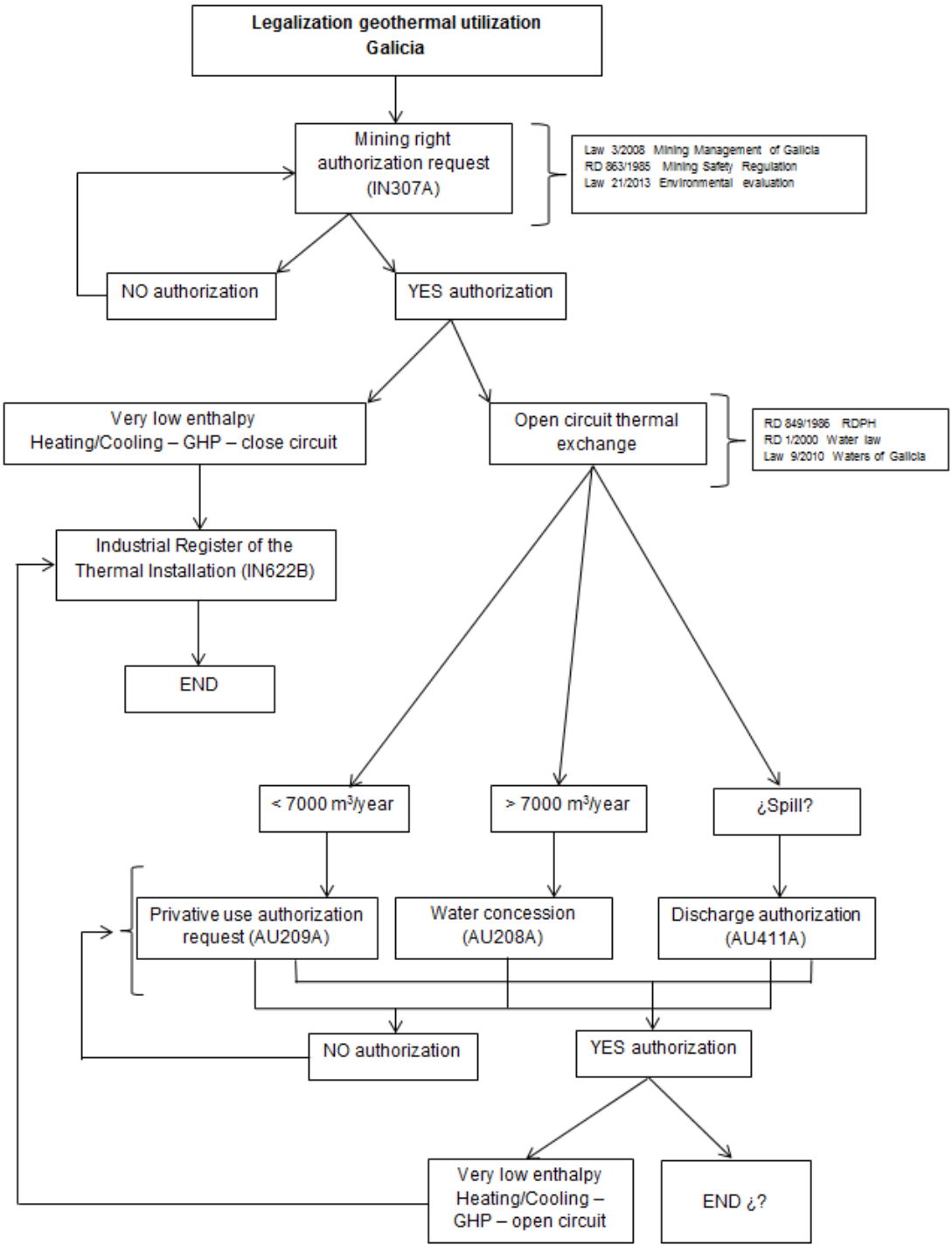
In the case of open-circuit geothermal installations, in order to obtain the concession to discharge the water after the thermal exchange, it will be necessary to demonstrate that the returned water does not affect the well or injection source in any way.

Once the authorization has been approved, and in the case of geothermal use of low enthalpy and is used for heating/cooling of a building, it would be required to make the registration of the installation in the register of thermal installations in buildings according to the procedure IN622B, whose information has been described in section 4.1.

[1] Hydraulic public domain is considered to continental waters, both surface and underground renewable regardless of the time of renewal; the channels of natural currents, continuous or discontinuous; the beds of lakes and lagoons and those of superficial ponds in public watercourses, underground aquifers, for the purposes of acts of disposition or affection of water resources; and the waters coming from the desalination of seawater.

[2] They are goods of the maritime terrestrial public domain: the shore of the sea and the rivers; the territorial sea and inland waters, with their bed and subsoil, defined and regulated by their specific legislation; the natural resources of the economic zone and the continental shelf, defined and regulated by its specific legislation.

4.3. Geothermal installation legalization scheme



Graphic 1: Geothermal installation legalization scheme

4.4. Standardization project to legalize geothermal installations

4.4.1. Cluster Association of Geothermal in Galicia (ACLUXEGA)

Currently, a specific procedure is in the process of being approved by the Galician government for the approval of drilling projects for geothermal use of very low enthalpy up to 200 meters deep in closed circuit, in which the following documentation is requested:

a. Data of the holder.
b. Location data.
c. Characteristics of the perforations.
d. Installation data.
e. Data of the project author and the technical director.
f. Coordinates that delimit the area of the perforations.
g. Initial and final foreseen limits.
h. National identification document (NID) of the holder physical person.
i. NID of the legal entity holder.
j. NID of the representative in the case of a physical person.
k. NID of the representative in case of legal entity.
l. Geothermal drilling project to be carried out, RD 863/85 of April 2, including appointment of the Facultative Director. General Registry of Basic Mining Safety Standards and its ITC 06.0.06.
m. If there are more holes, add the corresponding data on a separate sheet.
n. Document justifying the payment of the fee.
o. Power of representation.
p. Responsible statement in the case of not approving the project.

With the implementation of this protocol, it will be possible to expedite the procedures for the legalization of this type of geothermal facilities, which are the most common in Galicia.

The protocol of legalization of this type of facilities is promoted by the Cluster Association of Geothermal in Galicia (ACLUXEGA).

Once the authorization has been approved, and in the case of geothermal use of low enthalpy is used for heating/cooling of a building, it would be required to register the installation in the register of thermal installations in buildings according to the procedure IN622B, whose information has been described in section 4.1.

4.4.2. City Council of Ourense

For its part, the City Council of Ourense, in 2012 drafted a municipal ordinance to be implemented in the areas and perimeters of aquifer protection of the City Council, whose purpose is the regulation of regulating the conditions of execution and use of those works that directly or indirectly may affect the hydrodynamic conditions of the local and geothermal hydrological system in the municipality of Ourense. In particular,

the scope of application will be in the following types of works that will require municipal authorization:

a. Mining prospections for the use of common waters.
b. Mining prospections for the use of thermal waters.
c. Mining prospections for geothermal exploitations in closed circuit.
d. Piezometers, testwells or other works that penetrate more than ten meters into the rock mass.
e. Emptying and earthworks in lands with the presence of thermal outcrops.

Contrary to the proposal defined in the previous section 4.4.1, within the proposal of Council City of Ourense, administrative procedures are included both in closed circuit and open circuit geothermal installations.

5 Geothermal energy licensing authority

In the case of Galicia, and depending on the typology of geothermal use (closed circuit or open circuit), the public bodies that authorize or not this type of facility are:

- General Ministry of Energy and Mines.
- Ministry of Economy, Employment and Industry.
- Ministry of the Environment and Territorial Planning (Aguas de Galicia).

6 Inventory of geothermal resources and statistics

The use of geothermal systems in Galicia, focuses solely and exclusively on heating/cooling installations, so in the following sections will be detailed the statistical data of the facilities currently in operation in the autonomous community.

6.1. Geothermal heating/cooling systems in Galicia

Geothermal Climate Systems (GCS) of low enthalpy, used in the heating and cooling of buildings, are based on the use of heat stored in the first 200 meters of the earth's crust through the use of exchangers introduced into the ground in combination with heat pumps. The fundamental difference with traditional systems that use a gas boiler, gas oil or other fuel, is that the former operate through a process of heat exchange from the ground to the building or vice versa, while the latter are based on a process of combustion with the consequent emission of greenhouse gases.

Geothermal energy of very low enthalpy, with temperatures of just a few degrees is available anywhere on our planet, but like any other mining resource its use depends on the geological conditions of the area where its use is intended. In the case of the Galician Autonomous Community, the existence of a subsoil with predominance of crystalline rocks of high thermal conductivity (granites), easily drivable and with a very shallow water table, makes that practically all of its territory is optimal for the implementation of the GCS.

The sum of all these factors means that the energy efficiency and profitability of GCSs in Galicia are very high, as has been verified by EnergyLab after the monitoring of this type of facility. Consequence of this and the work of dissemination and promotion that has been carried out in recent years by the Ministry of Economy, Economy and Industry of the Xunta de Galicia, INEGA and the Cluster of Geothermal companies of Galicia (ACLUXEGA), the number of these facilities has multiplied without having attempted to quantify them until now. Due to this gap, and the limitations of not having all the information, it has been developed with the help of ACLUXEGA partners, an approximation to the number and power of these systems, analyzing the situation of this technology from its introduction to the present.

6.2. Statistics GCS - Galicia

The present study intends to make an approximation to the number of Geothermal Climate Systems installed in the Galician Community, from the introduction of this technology in 2007 to the present.

It is also the object of the study to try to quantify the thermal power installed in these facilities, in order to assess the impact of these systems on the package of energy and climate measures for the year 2020 and on the objectives of reducing emissions, increasing energy renewable and energy saving.

For the elaboration of statistical analysis, we have had the historical data provided by the installation companies associated with the ACLUXEGA Cluster, making an approximate estimate of the number of installations executed by companies not belonging to the Association in the same periods.

Given that there is no exact information on the power of each of the facilities, after consultation with personnel of these companies on the most frequent types and powers, the following assumptions have been assumed for the calculation of the total power:

- It is assumed that 60% of the total installations correspond to a small single-family house and an average power of 10 kW per installation is estimated for this typology.
- It is assumed that 30% of the total installations correspond to a single-family median house and an average power of 20 kW per installation is estimated for this type
- It is assumed that the remaining 10% of the total installations correspond to installations in companies, day-care centers, administrative buildings and the rest of the tertiary sector and an average power of 125 kW per installation is estimated for this type.

6.2.1. Conclusions

The Galician Autonomous Community arrived, at the end of 2016, to the figure of 1061 Geothermal Climate Systems with heat pump. This figure implies a use of this technology of 0,39 units per thousand inhabitants. Although this figure is still far from the levels of introduction in other countries of the European Economic Community, exceeded the rest of the Spanish Communities and Regions, in the best case (Madrid, Barcelona, País Vasco) the ratio should be close 0,15 units per thousand inhabitants.

The distribution of the number of systems per province points to a greater implantation within the cities of La Coruña and Pontevedra, which account for 75% of them. The lower number of systems in Ourense and Lugo is partly due to the lower population density, partly due to a greater ignorance of this technology and also to the geological conditions not so exceptional as in the Atlantic Provinces where the predominance of granite is a more added.

The number of installations executed decreased dramatically in the years 2008-2014 as a consequence of the crisis in the construction sector. Data from recent years confirmed the recovery of levels and values close to those of 2007, which were the largest number in the historical series.

In terms of total thermal power has reached the end of 2016 in Galicia reached approximately 26 MW. This figure, although still modest, is not negligible and, to give an example, it could represent the equivalent of 6,5% of power in the combined cycle of the Sabón Thermal Power Plant (A Coruña). Although the source used by GEOPLAT (Spanish Technological Platform of Geothermal Energy) is unknown for its calculations, in some of its reports it is estimated that the total geothermal power

installed in Spain reaches 168 MW. If this figure is true, Galicia, with only 6% of the country's population, owns 15,5% of the installed capacity.

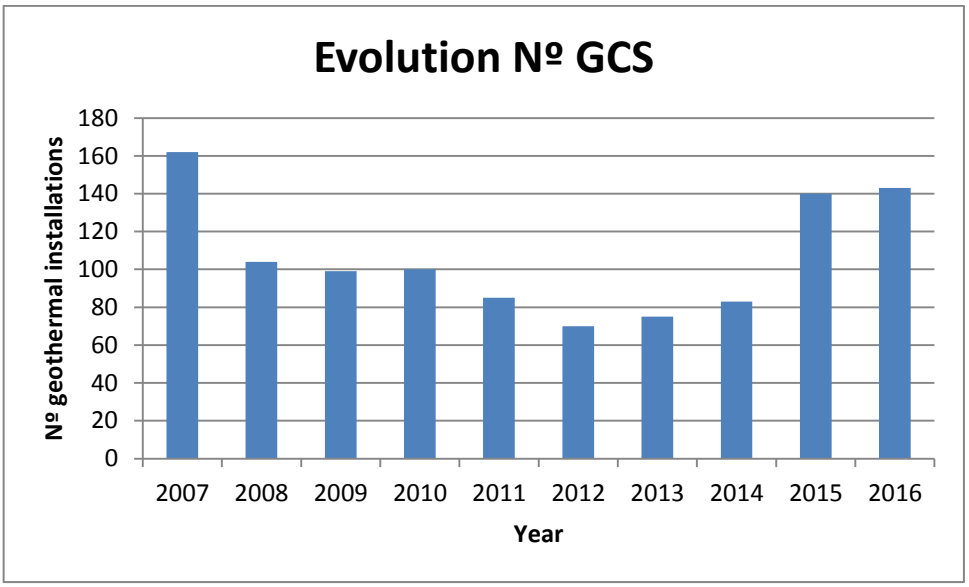
In recent years, a measure that popularizes these systems, there is a tendency to increase the number of GCS projects in large facilities. As a result, we must wait in the future and as the economic, operational, environmental and durability advantages of these systems become known within the business sector, the contribution of geothermal energy will grow exponentially.

YEAR	Nº INSTALATIONS	A CORUÑA	PONTEVEDRA	LUGO	OURENSE
2007	162	67	57	18	20
2008	104	43	37	11	13
2009	99	41	35	11	12
2010	100	41	35	12	12
2011	85	35	29	10	11
2012	70	29	24	8	9
2013	75	31	27	8	9
2014	83	35	29	9	10
2015	140	58	49	16	17
2016	143	60	49	16	18
TOTAL	**1061**	440	371	119	131
PERCENTAGE	100%	41,5%	35,0%	11,2%	12,3%

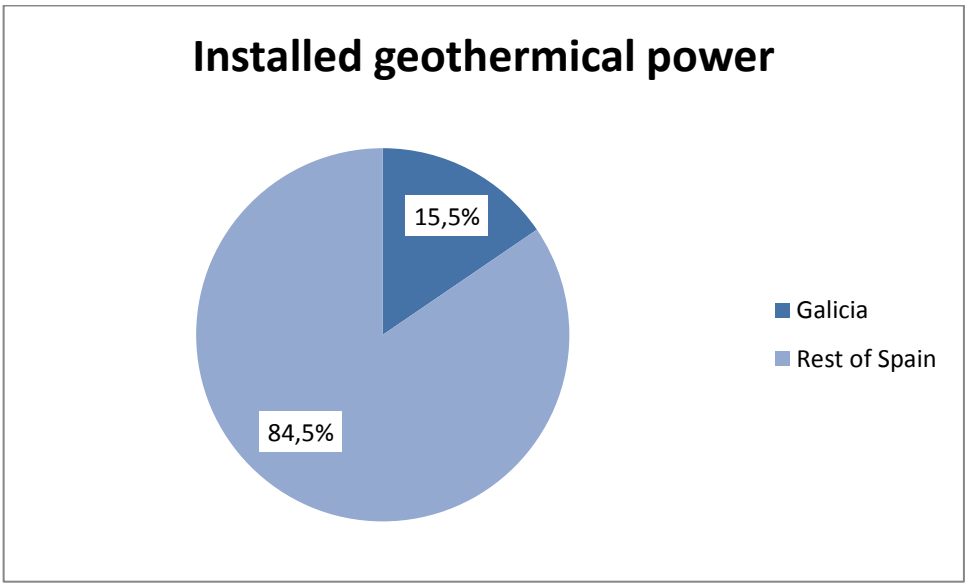
Table 1: Nº of GCS of low enthalpy in Galicia in each province

YEAR	Nº TOTAL INSTALATIONS	10 kW	20 kW	125 kW	TOTAL INSTALLED POWER
		60%	30%	10%	
2007	162	97	49	16	3969
2008	104	62	31	10	2548
2009	99	59	30	10	2426
2010	100	60	30	10	2450
2011	85	51	26	9	2083
2012	70	42	21	7	1715
2013	75	45	23	8	1838
2014	83	50	25	8	2034
2015	140	84	42	14	3430
2016	143	86	43	14	3504
TOTAL	**1061**	636	320	106	**25997**

Table 2: Nº of GCS of low enthalpy in Galicia depending on the power



Graphic 2: Evolution of geothermal installations in Galicia



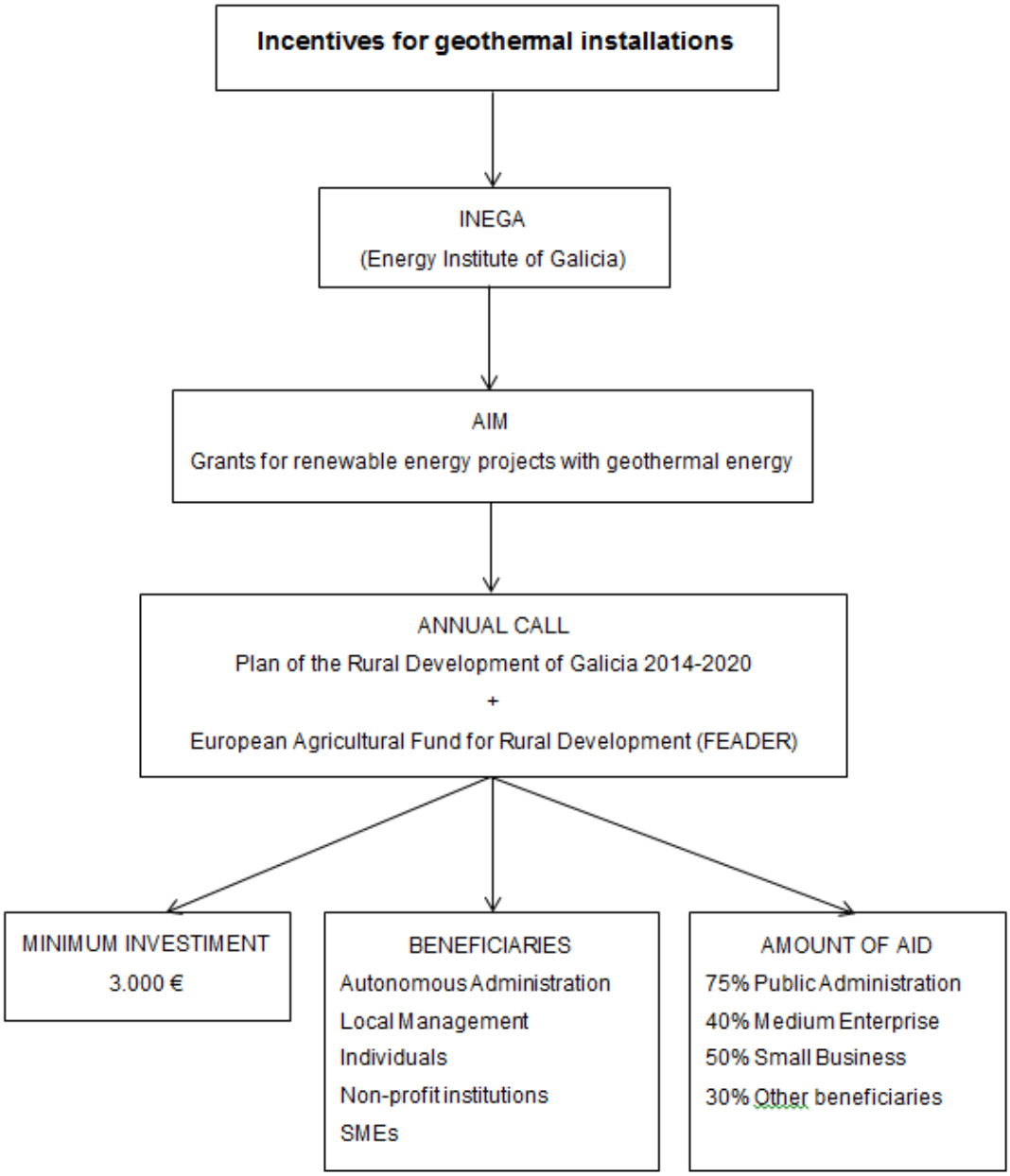
Graphic 3: Installed geothermal power: Galicia vs Spain

7 Financial incentives schemes

The Energy Institute of Galicia (INEGA), is the autonomous body responsible for encouraging the use of geothermal energy within the community, through the annual publication of calls for subsidies co-financed by the European Agricultural Fund for Rural Development (FEADER), within the frame of the Plan of the Rural Development of Galicia 2014-2020, for the granting of aid to the actions and projects of renewable energies that use geothermal energy.

Although the established regulatory bases of subsidies change slightly each year, as a general rule, they have the following points in common:

- Concept: regulate the connection of subsidies, in a competitive competition regime, to actions and renewable energy projects that use geothermal energy.
- Minimum investment: 3.000 €
- Beneficiaries:
    - Autonomic and Local Administration.
    - Non-profit individuals and institutions.
    - Small and medium-sized companies, their groups and associations.
- - Amount of aid:
    - The maximum aid intensity depends on the type of beneficiary:
        - ✓ Public administrations: 75%
        - ✓ Medium company: 40%
        - ✓ Small business and physical person: 50%
        - ✓ Other beneficiaries: 30%



Graphic 4: Scheme Incentives Geothermal Installations Galicia

9 Annexed – References list

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