



The Interest Group
GEODESY

Geodesists and the Energy Turnaround



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Impetus

► In 2011, the German government decided to phase out nuclear energy. The energy concept sets ambitious goals for the expansion of renewable energy, increased energy efficiency and less greenhouse gas. The so-called *Energiewende* – the energy turnaround in the meaning of a transition to renewable energy – is a mega-topic being widely discussed throughout society, and it is a vital contribution to sustainable development.

This challenge can only be met by a joint effort of politics, administrative bodies, business, science, and civil society. Germany has the potential of becoming the leading market for energy efficiency, climate protection and the expansion of renewable energy sources. As engineers, we rely on qualitative growth and prudent, responsible action. Thus we see it as both an obligation and an opportunity to make a significant contribution to shaping this market.

With this paper, the **Interest Group Geodesy**, formed by the three national geodetic associations

- **DVW – Society for Geodesy, Geoinformation and Land Management**
- **BDVI – German Association of Publicly Appointed Surveyors**
- **VDV – (Association of German Surveying Engineers – Professional Association for Geodesy and Geoinformation)**

calls attention to the contribution geodesists can make to the energy turnaround in the fields of geodesy, geoinformation and land management. It illustrates the broad range of geodetic knowledge and skills that can help in making the shift towards renewable energy come true.

Against the backdrop of the shortage of skilled labour in combination with the recruitment problem in the engineering disciplines, not least of all geodesy, this brochure must be seen as a complementary to the recruitment platform www.arbeitsplatz-erde.de, the goal of which is to attract young people to this highly interesting and sustainable professional field.





The Interest Group Geodesy

- takes the initiative in starting an intensive dialogue with decision makers and participants of the energy turnaround by issuing this paper;
- offers its services as a partner and consultant in the successful design and implementation of the energy



turnaround to the German federal government, the federal states and the municipalities as well as to non-governmental organisations;

- calls upon the political, administrative and economic decision makers to draw on the geodesists' expertise when taking decisions and implementing measures with regard to the new energy policy.

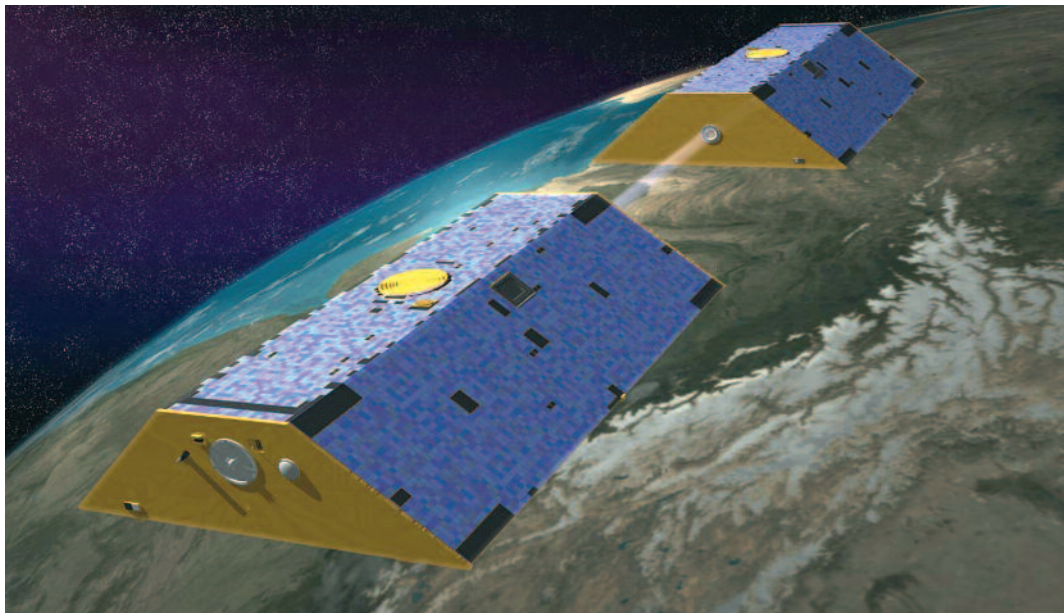
Geodesists are a specialist community of engineers and scientists exploring and measuring our planet and near-earth space and subsequently presenting the results graphically. Based on these data, not only navigational systems, topographic maps at all scale levels, nautical charts, aerial views and digital models of depths and elevations can be created but also city maps, 3D visualisations and evidence of ownership in the cadastre.

Geodesists gather, assess and visualise geoinformation in order to provide the fundamentals for decisions on the implementation of measures in the transitional process towards green energy in the fields of energy generation, transport, distribution and economisation by means of solar cadastres, wind power priority zones or routing.

Geodesists assist in forecasting natural disasters such as floods, earthquakes or tsunamis and thus in preventing substantial damage. They participate in the planning and management of smart grids for the expansion of renewable energy, thereby making an important contribution to climate protection.

Geodesists possess multi-layered and interdisciplinary knowledge and skills that enable them to provide measurable solution approaches for the successful implementation of the energy turnaround by

- letting the public participate in shaping procedures and finding solutions in close dialogue with all actors;
- gathering, up-dating and managing space-related information, for instance concerning the expansion of power grids for energy distribution, and visualising the data with the help of a geoinformation system (GIS);
- monitoring local, regional and global changes on earth within the framework of climate research by means of modern satellite technology, digital remote sensors or automated devices such as tachymeters;
- developing and implementing high-precision measuring techniques that help the German federal government, the federal states and the municipalities in disaster and energy management as well as in the staking-out and monitoring of the required industrial infrastructure;
- providing evidence of ownership and ownership rights in relation to properties subject to planning in the course of statutory procedures (legitimisation);
- drawing attention to problems, options and possible solutions in planning and with land restructuring strategies as well as to the instruments of land management in the course of projects related to the energy turnaround;
- evaluating properties with climate protection facilities (e. g. flood protection measures) or facilities that are used for the generation of renewable energy (e. g. wind power, bio or photovoltaic plants)



Challenge energy turnaround – Measurable contribution of geodesists

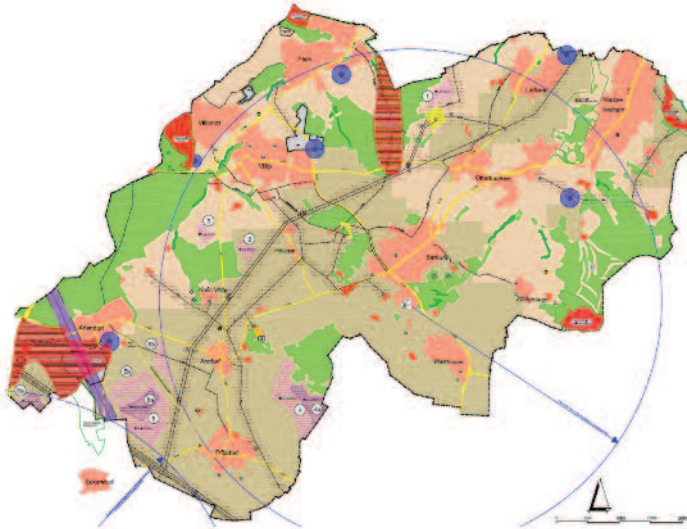
No geodesists, no geodata!

Nowadays, living together in a modern society as we do is unthinkable without the use of space-related information, so-called geodata. It is estimated that about 80% of the decisions taken by authorities and the business world are made on the basis of geodata, which are therefore also essential for making decisions on energy-related matters:

- Is there an increased risk of earthquakes, floods or landslides in the region?

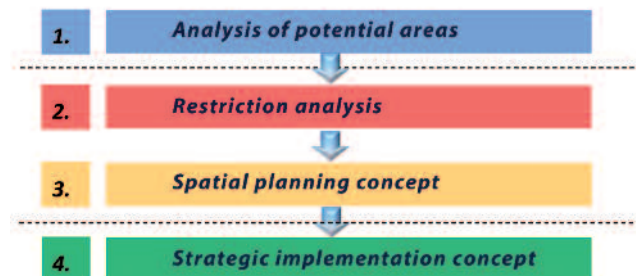
- In what regions can geothermal energy be used?
- What areas in municipalities are suitable as wind power priority zones?
- Which roof areas are suitable for the generation of solar energy?
- Which ownership areas are affected?
- Where can grids for energy transportation be optimally established that have to meet diverse requirements?

Spatial planning concept for wind power facilities



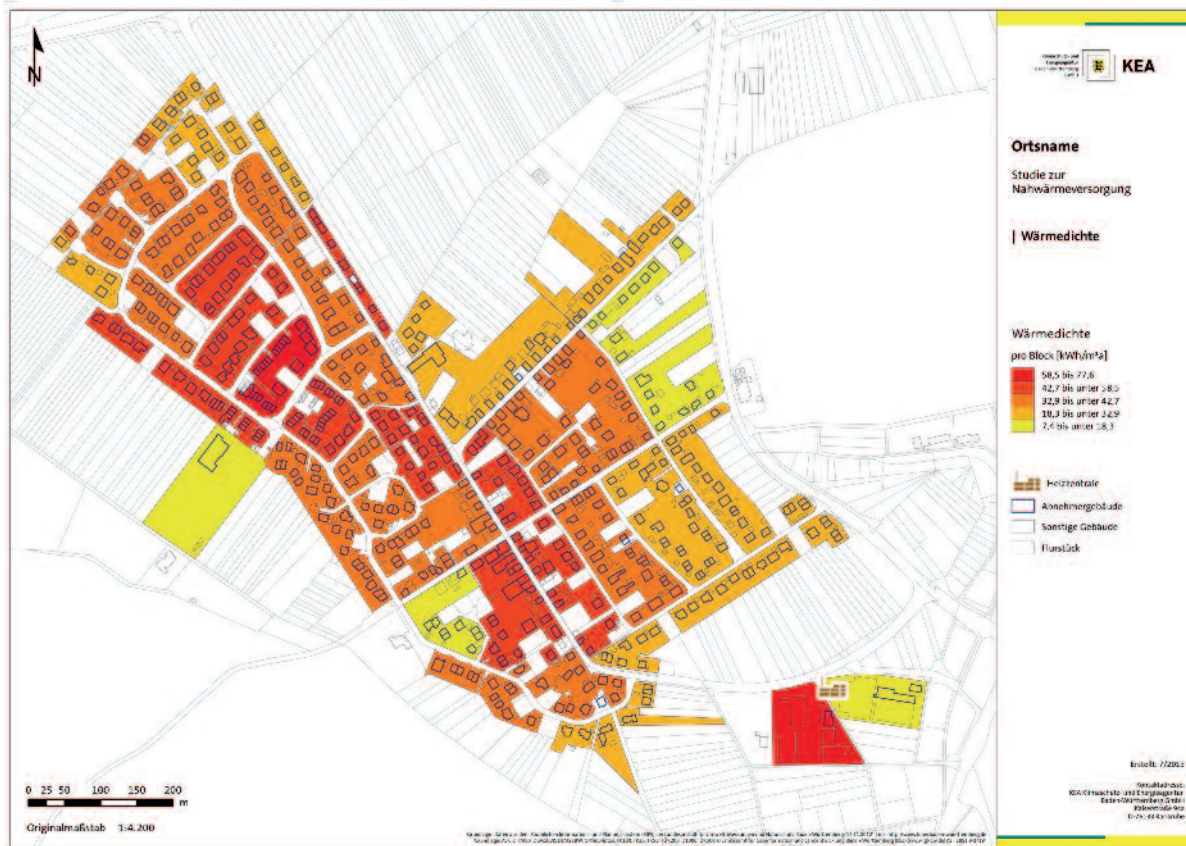
Source: Analysis on the designation of concentration zones for wind energy facilities in the municipality of Wachtberg, Bonn.

Strategic management requirements and planning phases for the designation of concentration zones for wind power facilities



Hence, the use of modern geoinformation systems as well as the gathering and assessment of geodata provide an objective basis for taking the space-related decisions that will arise in the course of the energy turnaround. 3D city models, for instance, allow the simulation of the spread of noise and emissions or the

prediction of the potential changes in the city's climate. In disastrous events such as floods, 3D landscape models make it possible to quickly determine what areas and buildings will be affected, thereby enabling the launch of suitable supporting measures at an early stage.



Renewable energy: Determine and evaluate regional potentials

Geoinformation can help identify and evaluate regional potentials for the use of technologies from the field of renewable energy using GIS as a “Decision Support System”. The required data and analysing tools are based on geodetic competence:

- What locations qualify for the construction of decentralised energy systems due to their topography, avail-

able roof areas or the framework of planning regulations they are subject to?

- Do the average wind force or the expected sunshine duration allow for a profitable operation of the decentralised energy systems?
- Is there enough space available in the catchment area to grow renewable resources for the operation of biomass power plants?
- Is the required traffic infrastructure available for the construction and operation of the facility or is there a connection to the electric power grid to enable the transport of the energy generated?



Decentralised energy generation: Keeping track with the help of geoinformation systems

Decentralised energy systems are of high economic value and have an expected life of more than 20 years. Geoinformation provides an ideal regulatory framework for the classification of all data and information regarding the life phases of a facility and their management. Geoinformation systems (GIS) are of great value when it comes to the integrated documentation of the lifecycle of these facilities during all 4 phases:

- In the planning phase, GIS supports the simulation and the drawing up of approval documentation through the efficient provision of planning data.
- In the construction phase, the commissioned firms have access to the planning data which helps to support and optimise construction through GIS.
- In the Operations & Maintenance (O&M) phase, GIS provides for an efficient coordination of maintenance work and the ongoing monitoring of the facility's geometry.
- Likewise, GIS supports the organised removal of the decentralised energy systems.



Earth from above: The energy turnaround and earth observation

The world climate is in constant change. Topics like the ice melting in the polar and continental glacier regions or the ongoing rise in sea level are of vital interest and significance. But there are also dramatic changes on regional and local levels. Do they reflect the increasing human interference in climatic processes or are they just



part of a natural variability? Is there any possibility that we could influence them within the framework of a suitable climate and environmental policy? In order to answer these central questions, up-to-date information (e. g. on sea levels or the length of glacier tongues and the changes they are subject to) has to be recorded as exactly as possible and integrated into time series to make changes visible.

Geodesy plays an important part in the measurement and analysis of relevant data employing geodetic sensors in space (e. g. gravity field missions) and on the Earth's surface (e. g. levels, GPS stations). Geodesists work interdisciplinarily and cooperate closely with other geoscientists such as meteorologists, oceanographers, geographers, or geophysicists.

No energy turnaround without geodetic measuring procedures

With the help of a solar cadastre and with just a few clicks, owners can obtain information on whether the roof of their house is suitable for a photovoltaic facility or a solar collector for hot water generation and heating support. Here, too, geodesists can be of help: Non-contact measuring methods via laser scanning enable a quick analysis of roof potentials for photovoltaic use. The solar potentials are either determined from original laser scanner data, through the photogrammetric analysis of stereoscopic aerial images or derived from a 3D city model. Special airplanes are used for the recording of data with the help of laser scanners and aerial images.

Another example of geodetic measurement are deformation analyses based on tachymetry and GPS in order to provide reliable information on possible deformations or periodic behaviour of buildings. In most cases, geodetic applications relate to engineering building structures such as bridges, barrages and dams but also to historic buildings which require constant monitoring due to the risk of floods or earthquakes, or to natural objects such as sliding slopes in mountain regions.

Terrestrial laser scanning and deformation analyses provide information and thus important findings on the vibration characteristics of both on-shore and off-shore wind power installations, particularly on the stability of off-shore wind farms.

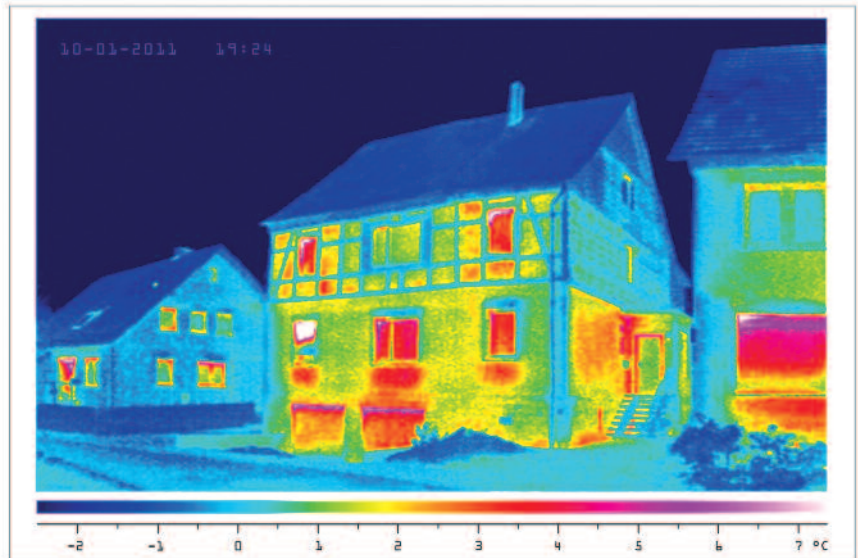
Geodesists and their precise measurement technology are also in demand when it comes to the exact staking out of these wind power installations. Apart from that, airborne laser scanning, the analysis of stereo images, tachymetry and 3D modelling support the shift to energy generation from renewable resources.

Geodesists offer products that make the management of disasters and energy easier for the German federal government, the federal states and the municipalities. They support building owners in planning their solar facility. In doing so, geodesists make an essential contribution to a decentralised and sustainable energy landscape.

Sustainable land management under the banner of the energy turnaround

Against the backdrop of dwindling fossil energy sources and the resulting increase in energy costs, urban and rural structures must be altered in an energy efficient way in order to face climate change. Climate protection goals are mostly determined on international or national levels.

In the course of implementing them, however, the regions, cities and municipalities also play an important part. The term “Smart Cities” describes a process towards attractive urban living and work environments. Geodata help in enhancing the digital intelligence of cities.



In urban environments, the shift to renewable energy means, for example, the application of energy saving measures on the building level in the refurbishment and new construction of buildings, the planning of measures that help to increase the efficiency of existing central power generation and distribution facilities, or the optimisation of traffic flows also using renewable energy.

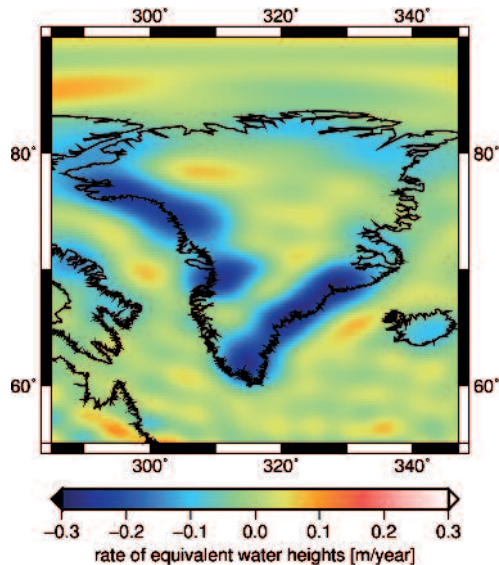
Here, climate protection is an integrative planning approach relating to different fields of action such as working, living, social infrastructure, supplies, waste removal and traffic and, as a result, must already be taken into account on the urban development planning level. Rural space plays an important part in the shift to renewable energy, particularly as it is here that the areas needed for

wind energy, water power, photovoltaic facilities and biogas are to be found. This also includes power lines for the creation of the required infrastructure and storage structure. In the face of the strains resulting from demographic change, the energy turnaround is both an opportunity and a challenge for structurally weak rural regions. All in all, it must be made sure that burdens and benefits of future energy generation and supply are fairly distributed between urban and rural regions.

Whether in town or country – there are numerous fields of action for geodesists. Which strategies and instruments of urban and rural development are at hand for the successful implementation of the energy turnaround (i. a. land use planning, land restructuring, land reallocation, village renewal)? How can the most suitable locations and areas for the use of renewable energy be developed and mobilised in a timely and cost-effective way? How can the public be successfully integrated into the process?

As land managers, geodesists identify demand for action in the fields of planning and land readjustment to support the spatial management and implementation of wind power, bio gas, solar facilities etc. and provide solution approaches for suitable planning and management instruments. They determine space potentials and ensure the required planning certainty, thereby making an important contribution to the acceptance of the energy turnaround by all who are affected.

The Interest Group Geodesy is convinced that, in the face of the limited availability of resources (space, funds, personnel), the existing strategies and instruments of land



management for an efficient support of the energy turnaround require constant monitoring and development. We offer our support in these areas.

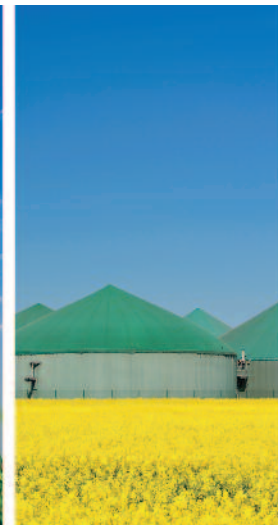
My home, my land, my wind turbine: The energy turnaround and property valuation

Land, buildings, properties – everything has its value. It is nothing new that properties are traded globally, making precise and up-to-date valuations all the more important. One of the prerequisites for property valuation is that documentation concerning the property in question is made available by geodesists: Which owners and (sub-) areas are affected, what rights (servitudes) exist? Also in the field of property valuation, geodesists bring in their professional expertise. They are represented in the local committees of valuation experts through participation in subcommittees that bring together profes-

sionals from the fields of construction, valuation and planning and where accurate values are determined from the most diverse data. For example, not only the location of a property plays a part but also its use or the existing infrastructure.

The topic of energy is being given increased priority in the merging of space-related data during property valuation: Has the subject property undergone refurbishment measures to improve its energy performance? To what extent do wind power facilities affect the market value of residential properties in use? How is the market value of an agricultural property with a bio gas facility to be determined? Do planning regulations for wind power facilities have positive (possibility to build) or negative (interferences due to close proximity) effects on property values?

From the point of view of the Interest Group Geodesy there is an increased need for discussion with political





players as well as other associations and organisations as to what the best valuation practices are when it comes to problems related to the shift to renewable energies, many of which are still to be solved in order to establish legal harmony and planning certainty for both public and private investors.

Transparency and participation: The energy turnaround and civic involvement

Active civic involvement is one of the basic principles of our democracy and a key factor of success of open and transparent planning methods. This applies just as much to the design of a municipal climate protection concept as to the location planning for a wind power or bio gas facility. Involvement procedures do not only take place within the framework of energy-efficient urban regeneration and village renewal but also in the entire field of land management, be it the planning for or the use of



undeveloped and developed properties (property management, land use planning), the rearrangement of building land in urban areas or the restructuring of land by reallocation in rural areas.

In the organisation of moderation processes and mediation procedures between affected owners and land users and the interested public, geodesists can rely on extensive positive experience. Procedures of civic involvement relating to the expansion of renewable energy, in particular, require the special knowledge and skills that geodesists possess due to their professional education and practice. Mainly due to their in-depth knowledge of the legal interdependencies between property cadastre, planning and land re-adjustment and their relations to other legal standards (e. g. the *Immobilienerwertermittlungsverordnung* – German Ordinance on the Valuation of Properties and the *Energieeinsparverordnung* – German Energy Saving Ordinance), geodesists are sought-after experts for an optimal communication between all parties involved.

The Interest Group Geodesy calls for participation to be embedded in the administration as an interdisciplinary task. This would mean that a tailored form of cooperation and involvement can be chosen or developed for every individual case. The offers for involvement already in place must be stabilised. Best practice examples and successes must be made visible as a model of “citizen-oriented administration”.

In order to achieve this, changes and alterations in legal provisions have to be made which ensure, in particular, that civic involvement can take place in planning and approval procedures from a very early stage. ■



BDVI

BDVI e.V.

The BDVI is the professional representation of Publicly Appointed Surveyors in Germany. As a trade and professional association it represents the interests of its 1300 members towards politics, economy and administration. The focus of the association's work is on supporting the individual professional as a part of the public surveying sector and, at the same time, accentuating the overall interest of the sworn freelancers thus supporting the profession as a whole. Publicly appointed surveyors are publicly appointed and sworn freelancers, entrusted with statutory tasks in the field of surveying and mapping. Comparable to notaries, they deliver public services through a private organisation. Publicly appointed surveyors are subject to governmental supervision and neither allowed to act in a relationship of superiority or subordination nor in a commercial way; their activities are governed by neutrality and an individual sense of responsibility. They are technical service providers for all tasks related to properties and buildings, but also advisors to and mediators between economy and administration.

www.bdvi.de



DVW e.V.

The DVW - Society for Geodesy, Geoinformation and Land Management - represents, promotes and coordinates the objectives and interests of its members in the fields of geodesy, geoinformation and land management. DVW contributes to the education, further training and professional development of its members and, in this context, also promotes national and international co-operation. It collaborates with technical and scientific associations, universities and other institutions and thus can rely on an extensive expert network. The DVW presents the achievements and the importance of geodesy, geoinformation and land management to the public and contributes to legislative proceedings at federal level.

www.dvw.de

VDV

VDV e.V.

The VDV - Association of German Surveying Engineers - is the largest professional representation of the interests of surveying and geoinformation engineers in Germany. One of its basic aims is to participate in the structural design of the German geodesy and geoinformation system. The VDV pools the interests and issues of its members both from the private sector and the public service representing them towards politics and society on national and international level. Furthermore, it gets involved in the education of highly qualified engineers and promotes an increased percentage of women in the profession as well as permanent professional training.

www.vdv-online.de

