



Engineering worldwide

The decade of fossil fuel and atomic energy comes to an end worldwide. Even though the subsidies for photovoltaic energy got lower in the past a great future is forecasted for the global development of regenerative photovoltaic energy. (Figure 1) With this handout we want to inform you about the solutions, which **AquaSoli** is able to provide to you, aiming at a brighter future of power plants.

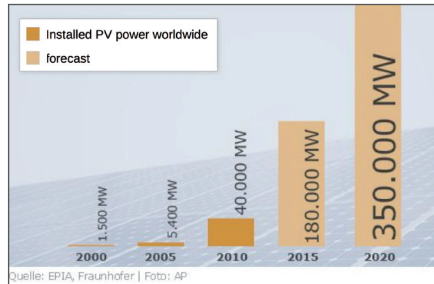


Figure 1: evaluation of global renewable energies
(source: <http://www.dw.de>)



**Kind regards to our
clients and
business partners!**

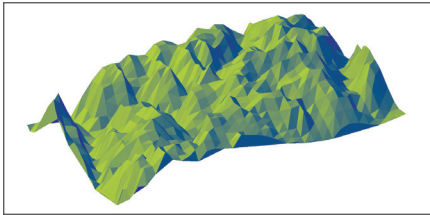
Dipl.-Ing. Jürgen Schmid

Our team is able to proceed worldwide the following topics:

- Testloadings for ramppiles and helix piles acc. to the valid standards as basis for an economic and safe foundation design
- Ground surveys for all necessary supplies on site like roads and transformer stations with design of the basement
- Chemical analyses for the determination of corrosivity of the building ground
- Field measurements of the site surface with Leica Geosystems for 3D-models as basis for the layout planning of PV-plants
- Shadow optimized layout planning for solar fields with Helios 3D, AutoCAD civil 3D) for different scenarios
- Electrical engineering of solar parks, including the forecast of power

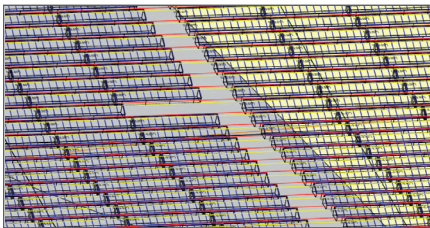
Shadow optimized layout planning for solar fields

To assure a most economic and efficient design of your PV-plant, AquaSoli is providing you the surface measurement with Leica Geosystems as the basis for the 3D surface model.



Picture 1: 3D model of the Zugspitze mountain

With that information the shadow optimized layout planning for any kind of mounting system could be designed. The shadow optimized layout planning aims at the highest cost effectiveness between costs and electric earning per year.



Pict. 2: Layout planning of a solar-plant in Autocad - with Helios

We are able to interlace all required parameters for each solar field and to convert them with 3D model to a complete CAD file of the whole field. That will include the mounting system all buildings and roads. If it is needed, we can provide the ramming plan of the foundations with all coordinates and to mark these positions on site. (picture 2).

Testloadings on foundations

According to all technical rules for pile foundations the most efficient investigation for the basement design are testloadings on site with the projected piles. Theoretical calculations of pile embedment depths and dimension based on conventional geotechnical investigations are added with much higher safety factors, so the pile size or the embedment depth might be taller than necessary or even much to shallow!



Pict. 3: Testloadings on mini steel piles on a 62 MWp PV - park

Also the feasibility study (acc. to EC7) of the pile installation, which can sometimes be difficult due to obstacles in the building ground, can only be achieved along with testloadings. With testing different shaped piles at one time the best profile or installation method can be chosen.



Picture 4: Destroyed by obstacle - ramming profile during testloading feasibility study

Ground surveys

With the evaluation of direct outcrops (drillings or excavated pits), indirect methods (dynamic probing or vane tests) on site with the corresponding laboratory work the building ground for roads and supplies can be verified. This investigation can be achieved in one step with the testloadings for the power plant (picture 5). The report about the building ground and the testloadings is the basis for draft, verification and achievement of the mounting system and the foundation design of buildings, roads and drainage systems.

If needed, we also rate the corrosion potential of the soil and the abrasiveness at concrete.

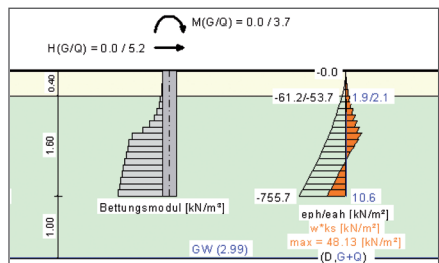


Picture 5: Ground surveys nearby Tuscania/ Italy

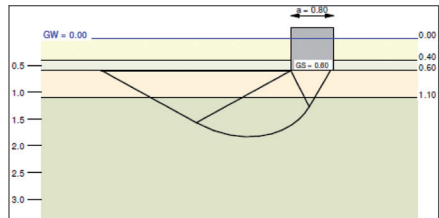


Foundation design

PV-plants and their supplying buildings have to be founded safe and economic. AquaSoli is able to achieve the whole concept for foundation and the necessary geotechnical proofs for public authorities. (picture 6).



Picture 6: Simulation of impacts on pile foundation(above), design of a spread foot foundation (down)



According to the building ground conditions our engineers are able to provide you with mini steel pile- / Helix pile- or spread foot foundations for an economic and safe solution. The design of roads, drainage systems and buildings are calculated with specific computer programmes based on the results of the ground survey.

Electrical works design

The economic and efficient planning of all cables, connections and transformer stations became an important part of our work scope. **AquaSoli**, with its qualified technical staff, field specialists and specific software tools, provides high quality electrical design for the PV-plants and PV-roof systems.

FEEDER PANEL	CONNECTED TOTAL LOAD (W_{AC}):		DEMAND TOTAL LOAD (W_{d2}):			
TRANSFORMER-1	2.160.000		1.527.120			
PANEL TAG: FROM	DESTINATION EQUIPMENT OR PANEL TAG	INSTALLED AC POWER(W)	DEMAND FACTOR	DEMANDED AC POWER(W)	VOLTAGE(V)	DISTANCE L(m)
INVERTER-1	TRANSFORMER-1	720.000	0,707	509.040	380	120
INVERTER-2	TRANSFORMER-1	720.000	0,707	509.040	380	120
INVERTER-3	TRANSFORMER-1	720.000	0,707	509.040	380	120

Picture 7: Electrical calculations in detail

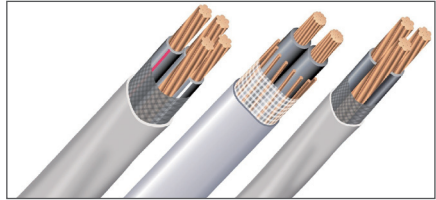
Before building a solar power plant it is important to get to know exactly about the material (PV module, cable length etc.) needed on site. Therefore **AquaSoli** proposes precise quantity calculation solutions to save time and money on your investment.

Voltage drop calculation

At the moment the life time of a PV-plant is about 25 - 30 years. During this period, the most important criteria is effective and high quality energy production, this is guaranteed by scientific voltage drop and selectivity calculations for each main load group in the PV system.

PV cable selection

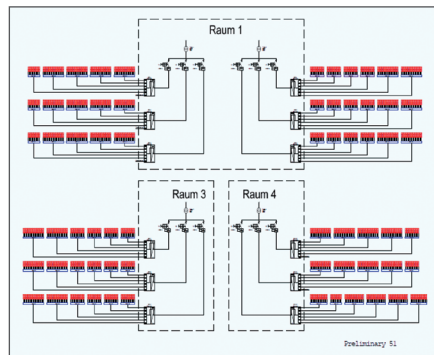
Independend from the place the project will be erected **AquaSoli** selects the proper cable type & size by taking IEC or NEC standards into account; as a result of scientific calculations.



Picture 8: Different cable size & type (source: SouthWire)

Single line diagram

Simplified notation of the PV-plant power system helps to get an overview on power flow through all power related devices. **AquaSoli** also proposes electrical single line diagram regarding to the specific PV-plant.



Picture 9: Typical representation for PV-plant electrical system