DEMOKRIT

Distributed **E**✳**Mo**bility in **Kriti**

A short description of a concept and feasibility study for the implementation of a solar-powered public and private e-mobility system for citizens and visitors of the Mediterranean Island of Crete (Kriti) in Greece.

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July 2013, Version 7.4

BACKGROUND

The **Island of Crete** in Greece is the 5th largest island in the Mediterranean with a population of about 625,000 Greeks and around 100,000 people of foreign nationality, who are constantly living on the island. Crete is significant for the birthplace of the **Mycenaean Civilisation**, focal point of Hellenistic as well as Venetian Culture and unique reservations of unspoiled nature, which makes it probably the most important one. Crete has unique archaeological sites, a wonderful climate, is home to a proud and creative population, it is a **tourist magnet of the first order** (hosting more than 4 million tourists p.a.; 25 % of tourism in Greece) and it is a prominent farmer location for **fruits**, fine **wines** and world famous **honey & olive oil**.

But the island has several problems:

- The **power generation** is inadequate; it is based solely on the combustion of diesel and marine oil. The power supply is poor and deficient. Constant blackouts are common.
- The **traffic situation** is the same: nearly all tourists rent cars and travel across the island, but the roads are out-dated. The traffic, in particular the transport of goods is dangerous and the costs of fuels run away exceptionally quickly.
- Crete has **no attractive public transport system**; only coaches interconnect the northern municipalities; the island has verbally no rail-based public transport network.
- The economic situation in Crete is characterised by high **unemployment**, **declining incomes** and **rising prices**. And although **tourism** - the backbone of the Cretan economy - **is in trouble** due to lack of investment and while it has lost contact to its competitors in many places, this year tourists from abroad will fill the gap the collapsed domestic visitor's market has torn (bed occupancy rate of over 95%). They do it because they love the island: 80% of all visitors come back year after year and bestow Crete the best returnees rate worldwide.

HOW TO »RESET« CRETE

In this situation many people in Crete are discussing how to »Reset Crete«. There is already a real »**Reset Crete Movement**«. With this project proposal we want to support the »Reset Movement« on the island. But after many years of project experience in Crete and with the Cretans, we know any new development on the island should be carefully examined, discussed and debated with those who are concerned, if it is to be successful. Therefore we are convinced that our innovative **concept must be evaluated and investigated** for possible unintended side effects. We also propose, that the results should be implemented in a discourse of civil society in Crete and translated into a master plan.

Our proposal is a brand new **energy & transport concept** for Crete which seems to be very challenging. But we want to demonstrate that it is feasible to …

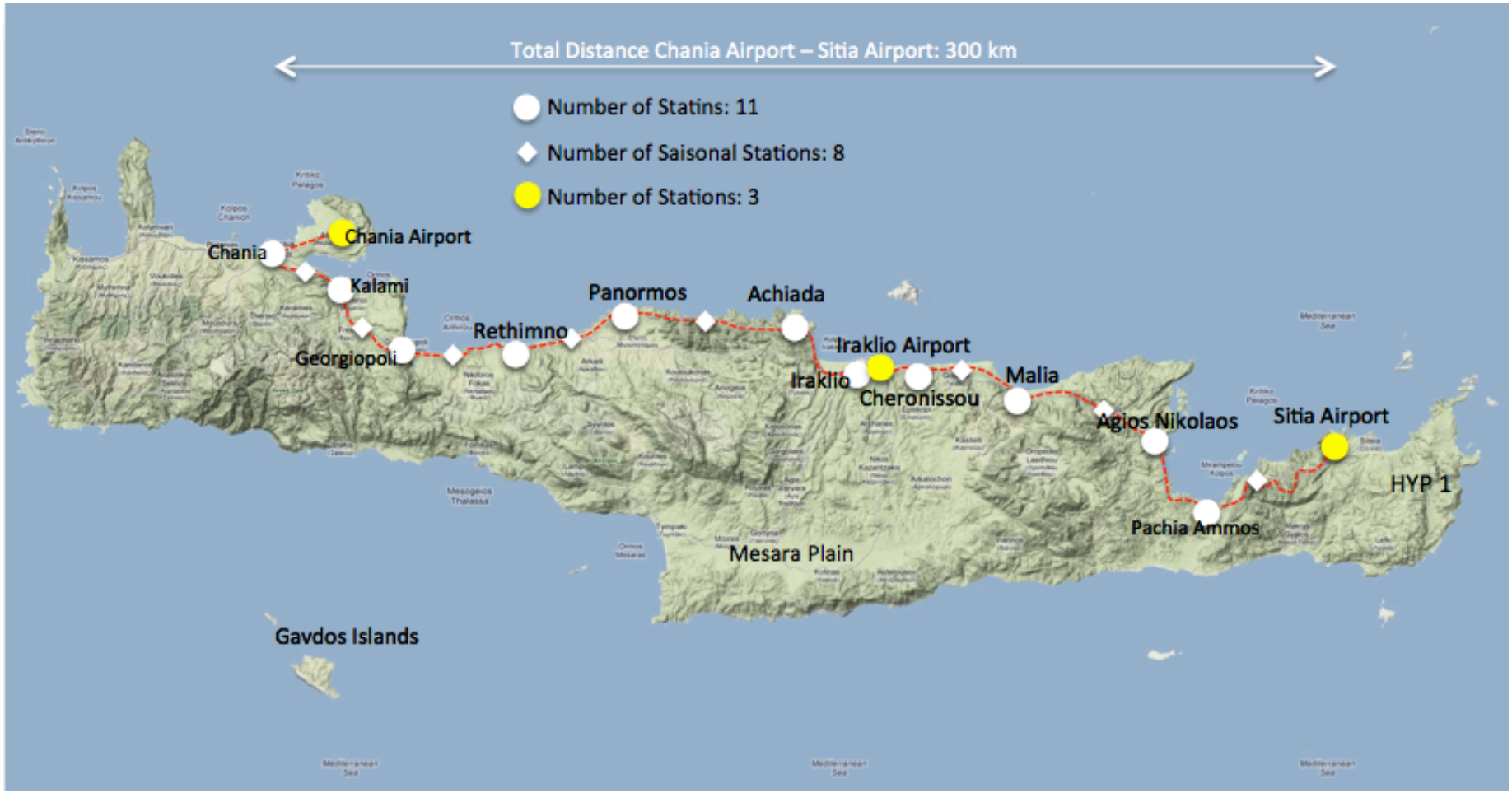
- ✳ establish the **missing public rail traffic** as a modern, fast and environmentally friendly system for citizens and tourists;
- ✳ connect this **rail system** with a modern and environmentally friendly **private transport system** of electric vehicles;
- ✳ take the **power** for this rail system not from the weak Cretan supply system but from an **autonomous self-supply system**;
- ✳ establish a **real tourist attraction** in Crete because DEMOKRIT is an architectural masterpiece that fits into the island (in form and material) in a way that you will not find elsewhere;
- ✳ establish a **low-cost and mass-accepted railroad tariff system** and customer/owner system, which leads to a genuine acceptance and perhaps reach cult status;
- ✳ **create jobs and stimulate the economy**, because the system is a job machine. The tourism will be boosted so that the entire economy of the island will be strengthened;
- ✳ **develop and construct** the main technical components of the system directly on the island;
- ✳ use **new composite materials** and design principles that have, unlike conventional materials, a minimal CO_2 footprint due to innovative and energy-saving design, construction and assembling of electric vehicles of all kinds.

THE CONCEPT

These objectives shall be implemented with the concept study:

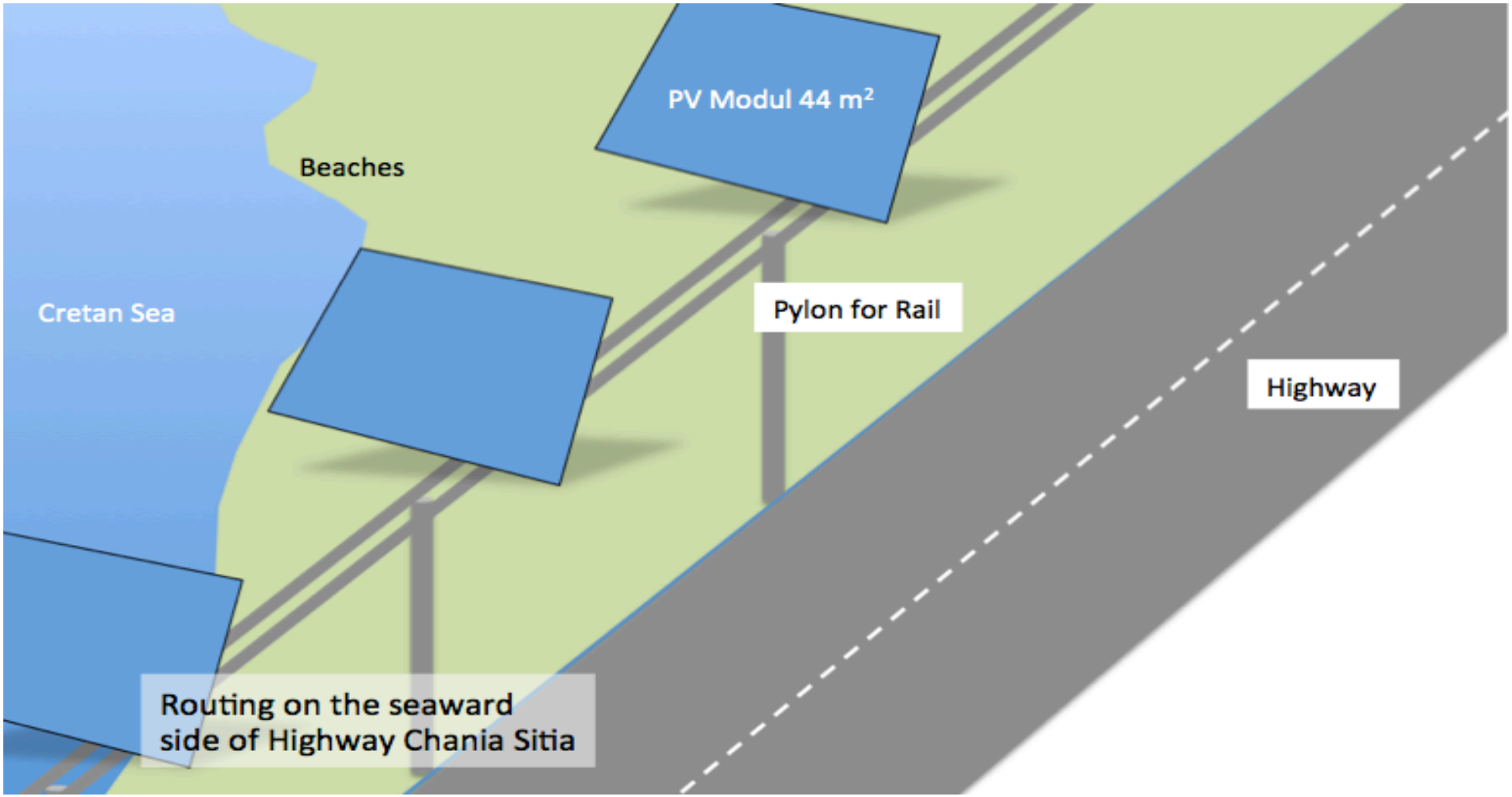
- The **Cretan airports and seaports** of Chania, Heraklion and Sitia as described in Figure 1 are to be **connected with a monorail train** with aerial guideway structure, similar to the one that is currently constructed in Brazil for the Olympic Games (Bombardier Innovia Monorail 300). On this route, all other towns on the northern coast of Crete, which lie between the airport and the main focus of tourist attractions in Crete are to be tied. The rail track serves both passenger and cargo, e.g. 40 foot oversea container.
- The routing system with its **approximate length of 300 km** shall be used on the entire length to **integrate** the highest number of **photovoltaic modules** directly in or on the aerial guideway construction, the station buildings and all other constructions like parking lot roofs. As shown in Figure 2 the entire PV power plant is taken to build a **200 MV line** to generate the power for both trains and electric vehicles of all kinds.
- The **stations** are also to be the **distribution and service centres** for electric cars, electric bicycles or electric scooters. Individual and public transport form a conceptual unit. Anyone traveling by train, acquires (optional) the right to use and share all other electric vehicles. If you want to share an e-car or a pedelec bike you may also take the train conversely. The stations are therefore at the same time technical and logistical venues for the private electric transportation sector. This model explicitly allows room for other stakeholders (e.g. private car rental companies or electric vehicle showrooms).
- The **electrical supply of the private e-transpor**t is to be handled via the railway stations. The e-cars, e-scooters and e-bikes shall be maintained here by fast charging or battery replacement (see »Better Place« or »TESLA Motors«).
- Since in particular the e-cars but also e-bikes are very expensive at the moment we propose to **manufacture or assemble electric vehicles directly in Crete** that are particularly competitive. Priority is given to new production technologies and new models.
- Particular attention shall be paid in this connection to the **processed materials** and their **CO_2 footprint**. Therefore primarily natural composites shall be used that have less than 10% of the CO_2 balance of steel or aluminium. The raw materials for this should come from the local Cretan agriculture, specifically for economic and ecological reasons.
- The system requires a **uniform tariff and user system**. An attractive tariff model for visitors and citizens is to be develop. This tariff system should also include cultural and tourist activities. With the train fare a broad concept of car-sharing is connected, which is separate from the conventional car hire system or even replaces it.

FIGURE 1



Monorail Routing in Crete

FIGURE 2



Integrated PV Power Plant

THE TASKS

The investigation tasks of the study, divided into 10 sections, are as follows. The topics will be covered by and with the partners (which have partially not been included in the planning yet, but are listed here as the experts, see »Disclaimer«), discussed and then implemented by them.

The investigative tasks of the study are as follows:

- **Construction of the railway, routing, environmental influences:** Bombardier together with an important British architectural practice and in cooperation with ZETA Constructions SA and the Technical University of Crete to investigate: the rail concept, the features, the design of the features, the design of the stations and the construction of the railway line. Bombardier to investigate the combination of passenger and cargo traffic.
- **Integration of the PV power plant:** Solar Company, Mechatron and the architectural practice to investigate the PV power plant concept, the design of the equipment, building integration, etc.
- **Overall architectural solution:** Architectural practice to develop the total architectural design of the track, the stations and urban places as well as the interior of the trains.
- **Operation and maintenance of the trains:** Bombardier to develop the concept of operations and maintenance of the monorail trains »INNOVIA 300«
- **E-Mobility Integration into the stations:** Bombardier, NAMCO, Fraunhofer IFAM, Solar Company and the architectural practice to examine how the private electric vehicles can be integrated in the stations and in the entire system under alternative approaches.
- **Design and manufacturing concept of private electric vehicles:** NAMCO, Fraunhofer IFAM, Onyx Composite and TU Crete develop cost models for e-vehicles, both pubilic and private transport should also be matched. Onyx Composite to develop a concept for the use of natural compounds for frame & bodywork. Amongst others, the concept is being developed as the Cretan agriculture may be involved in the delivery of raw materials.
- **Car-Sharing & tariff system:** Fraunhofer IFAM to develop a functioning tourist fare system based on different models of renting and sharing.
- **Modes of funding:** Solar Development Consulting UG to develop a comprehensive financing strategy for planning, construction and operation of the entire system including the power generation and the DEMOKRIT marketing.
- **Acceptance studies, economic impact:** Solar Development Consulting UG conducts extensive social science research about the acceptance of DEMOKRIT.
- **Discourse in civil society:** Solar Development Consulting UG to organise with representatives of the European Parliament the social discourse on the concept of civil society in Crete.

WHAT´S SO INNOVATIVE?

In our opinion the following:

- The **combination** of rail-transport with an autonomous power generation and supply from renewable sources, which also can feed a fleet of electric vehicles or other e-powered technologies.
- The design of the entire system with a **comprehensive design** that covers all system components by architecture with a sensitive link back to the environment and culture of Crete. Never before has an architect designed and implemented an entire public transport system with tracks, stations, squares and other buildings.
- The combination of a transport system for both **citizens and tourists** with a simple and harmonised tariff and sharing model for trains and private transport in an e-mobility concept for a whole island.
- The concept of developing well-functioning and **low-cost electric cars** with a **thoughtful charging concept** while using natural composite materials that have a minimal CO_2 footprint. Those raw materials come from agriculture on site – on a traditionally agriculturally dominated islands in the Mediterranean.
- A major project of this kind joined in a **social discourse in advance** - in the sense of a learning process for citizens and decision-makers to develop the concept and to have accepted by the public, so that the project itself can be considered a contribution to the growing energy consciousness of the Island of Crete.
- DEMOKRIT promotes **international cooperation** for future partners in the creation of the internal energy market by the rational use of energy resources and the access to renewable energy sources for sustainable development. As unquestionably the project does this through the **rational use of energy resources** and the access to renewable energy sources for sustainable development. The intended **effects of the economic** approach are equally positively as they affect the entire European financial and economic situation positively.
- DEMOKRIT is to develop a modern, environmentally friendly and socially defensible **solution to the energy shortages and massive traffic problems** in the island. Crete should not be the "battery of Europe", it is to benefit from its own resources on the island through a **cost-effective, energy-self-sufficient and sustainable transport system of public and private e-mobility** for tourists and the Cretan population as well so it can offer a working way out of the cost and supply gap on the island.

WHAT´S THE MAIN VALUE OF DEMOKRIT?

The **main added value** of DEMOKRIT, however, is:

The concept can be a model **solution for the Mediterranean region** in total**.** When this model can be implemented in Crete, it is also applicable to all other islands or regions with similar conditions in the Mediterranean or elsewhere. It has therefore a **dedicated European value** for the EU Member States of the Mediterranean region mainly affected by the euro and state crisis in particular. And it meets a number of key transport policy objectives of European Policy that are:

- The proposed concept of a **solar-powered monorai**l for both persons and for goods is a very efficient mode of transport, which contributes in an outstanding way to a significant **reduction of the circulation of private vehicles and road freight**; and by the way this monorail is an exceptionally clean, self-sustaining and energy-efficient vehicle by itself.
- The proposed concept for the explicit production of efficient and cost-effective electric vehicles contributes in a marvellous way to **transform the market towards more energy efficient vehicles**. Our proposal, however, is focusing the energy efficiency issue not only on **traction technology**, but also on the technology of **manufacturing vehicles** and **production of materials** from **natural compounds.**

PROPOSED PARTNERS

SOLAR DEVELOPMENT CONSULTING UG
(GERMANY)

BOMBARDIER TRANSPORTATION GMBH
(GERMANY)

IMPORTANT ARCHITECTURAL PRACTICE
(UNITED KINGDOM)

HQ NAMCO INTERNATIONAL AG
(GREECE)

ONE OF THE WORD LEADING SOLAR COMPANIES
(GERMANY)

FURTHER PARTNERS

FRAUNHOFER IFAM BREMEN
(GERMANY)

MECHATRON PV
(GREECE)

ONYX COMPOSITES GMBH
(GERMANY)

ZETA CONSTRUCTION
(GREECE)

TECHNICAL UNIVERSITY OF CRETE
(GREECE)

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