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From the Alps to Shanghai, Dubai and Sydney

Swiss innovation with solar energy

Ladies and Gentlemen

We all know it: The world population needs ever more resources. The demand for water and energy is increasing strongly throughout the world. The impacts of this development present us with enormous economic and ecological challenges.

Innovations are needed here, new solutions for the future. These mainly concern:

- The economical coverage of the increasing needs of the population,
- The relief of the pressure on environmental resources, above all water and energy.

The EXPO ZARAGOZA 2008 will be concerning itself with these central challenges of our world. It is therefore a great pleasure and an honour for me to now present to you a unique innovation by Swiss engineers, namely the attractive GOLDFISH PROJECT.

1. Foundation of the project

The foundations of this project are 20 years of experience in the development and utilisation of solar energy. The ambassadors of the GOLDFISH PROJECT who are present here today represent a well-qualified team of solar specialists from the major Swiss energy company, BKW FMB Energie AG, with its head office in the Swiss federal capital of Bern.

This company has an expertise in the development and application of solar energy that is unique worldwide. Over the last 20 years, it has realised a series of internationally significant projects and installations in Switzerland. These include, in particular:

- The first large solar power station in Europe on Mont Soleil (1992),
- An international Photovoltaic test centre on Mont Soleil (since 1995),
- The world's largest solar-powered ship on Lake Biel (since 2001),
- The world's largest stadium-integrated solar power station in Bern (since 2005),
- Participation in the Solar Impulse Project of Bertrand Piccard (since 2005),
- The world's highest solar power station on the Jungfrauoch (2008) and Kl. Matterhorn (2009).

2. GOLDFISH in the Swiss Alps

On the basis of their wide experience in solar power, the innovative team of engineers at BKW FMB Energie AG undertook to build the

first floating, mobile, solar power station in the world.

The idea behinds the project was to create a solar power station that could be utilised in a flexible manner. It should be able to be used commercially in very different regions of the earth for different purposes, and should make a contribution to relieving the demand for the scarce resources of energy and water.

The project idea focussed in the following

- Energy requirements on and near the water,
- Ecologically and economically based interests,
- Changing energy needs at the local level,
- Bodies of water without high waves with high sun exposure.

An innovative project implementation has been developed to test the feasibility of the project: The GOLDFISH PROJECT. This means: The utilisation of the floating, mobile solar power station for the operation of a solar-electric powered submarine on Lake Thun in front of the world-famous backdrop of the Swiss Alps. The project leader, Matthias Zellweger, will now describe this project to you in detail.

3. The Project

Sun, water and technology – mobile green energy – let yourself be surprised! With the snow-covered mountains in the background, the visitors arrive at the solar platform – the mobile solar power station – by water, and experience it as a floating island in the lake. This mobile island acts as the energy provider for the submarine – from here, we enter the submarine and dive down into the crystal clear waters of Lake Thun – and enter into a fascinating underwater world. After this very special experience of Nature of a very different kind, we return to the island and travel back to the shore over the water in the solar boat.

The potential for fascination lies in the submarine on the one hand, but also in the , floating solar power station on the other. It is indeed this solar power station that is the major technical element – and which vividly demonstrates the concept of renewable energy.

- The focus is not primarily on the submarine, but the idea behind the concept: We can sail and dive a submarine using solar energy.

The submarine of the Swiss Auguste Piccard is the first tourist submarine in the world. As a Swiss invention it was used successfully in Lake Geneva at the Expo 1964 in Switzerland. It is currently in the Swiss Transport Museum (Verkehrshaus der Schweiz), ready for restoration.

- The subject of submarines is fascinating – but we will first concentrate on the mobile floating solar power station, because this is the central element for all the applications.

The energy that is produced by the solar power station should be sufficient for the dives of the submarine, and should also guarantee the safe operation of the platform itself.

The platform will be automatically positioned by means of GPS at all times. This small platform can hold up to 60 persons and is the mooring point for the submarine and for the solar boat.

4. The concept

The concept consists of the following elements:

- The main platform – with a diameter of approx. 15 metres
- The satellite islands
- The landing point for the solar boats and the submarine
- A weather-protected waiting area and the information zone are located in the centre.
- The 5 solar generators, each of which has at least 40 m² of solar surface area. The on-board computer calculates the optimum angle for each of these solar generators.
- Swivelled electrical drive units are located under the platform. The propellers are used for the dynamic positioning of the platform and can be rotated through 360°.

And now to the submarine. Has anyone among you ever experienced a trip in a submarine? Has anyone ever experienced a „dive in the Alps“?

The number of passengers in submarines that are used for tourist purposes strongly depends on the operating concept. From a technical point of view, numbers from 16 to 36 persons are ideal. The minimum usable cross-section of the space is a decisive factor for the requirements of space and seating arrangements. The internal dimensions of the hull must be greater by the order of any insulation and infrastructure depths.

The costs increase in a non-linear relationship to the number of passengers. From a commercial point of view, the increasingly expensive transportation and any infrastructure dimensions are a decisive element.

The depth of the dive. For reasons of insurance, the submarine may only operate in areas with depths for which it is designed. Standard tourist boat classes are designed for diving depths up to 300 m. Considerably more sophisticated material is prescribed for boats with greater diving depths.

As a possible model, you can see a product of US Submarines in the picture, which can carry up to 24 passengers, has a draught of 2.7 m, a weight of 72 tons, a diving depth of 300 m, a surface speed of 9 knots and a horizontal underwater speed of 5 knots.

Welcome on Board – Here, we are looking at the world of water through the cockpit. Safety enjoys the highest priority in submarine technology and largely determines the construction of every submarine design.

Multiple safeguards for all possible risk scenarios are laid down by regulation; These apply to both the design and the operation of the submarine. Internationally recognised certification bodies make the decision regarding an operating licence.

5. From the GOLDFISH to the GOLDPORT

As you have heard, the GOLDFISH project idea is feasible. It is possible to operate a tourist or commercial submarine from a mobile solar platform in an environmentally friendly manner.

We are currently looking for national or international investors for the realisation of the GOLDFISH PROJECT. The early stage of the project makes it possible to still actively

involve interested parties in the implementation, design and naming of the project. The total financial requirement is approximately 10 million US dollars.

The worldwide potential of the project is great. Mobile floating solar platforms will certainly be able to make increasing valuable contributions in various areas of the Earth with regard to both ecology and energy. In particular, they can contribute towards the environmentally-friendly and economic fulfilment of transportation and infrastructure tasks.

Geographically, its use could be considered wherever space conditions are at a premium due to dense development and where calm bodies of water can be made use of in settlement areas with a high level of sunshine. River and port areas that meet these requirements could also be considered. The idea of the GOLDPORT thereby arises from the GOLDFISH.

6. Many possible implementation examples worldwide

If we think of forward-looking, sunny and densely populated major cities with suitable bodies of water, a number of locations come to mind almost immediately. There are examples here in Spain, and many more worldwide. We have chosen three of these as illustrations: Dubai, Shanghai and Sydney.

Dubai example

Application examples of many different kinds can be found in the strongly ecologically-minded Emirates. For example, the attractive subject of emission-free mobility with mobile solar platforms could be implemented in Dubai. Both solar-electric powered ships and submarines could be usefully operated, for example in connection with the Burj Al Arab Hotel.

Shanghai example

Passenger transport across the Huanpu River in Shanghai could be carried out in the future using solar-powered ships. Thousands of tons of CO₂ emissions could thereby be saved. With a view to the World Fair in 2010, this dynamic, forward-looking city could make a considerable ecological contribution in this way, and send out a long-term signal that would attract attention worldwide.

Sydney example

A number of very different application examples for mobile floating solar platforms can also be found in Sydney. Would it not be tempting to carry out cultural events in the world-famous Sydney Opera House that are powered with solar energy? With energy, in fact, that is generated in the immediate vicinity. Furthermore, the platform itself could also be used for events of all kinds.

7. Dream or reality?

The GOLDFISH PROJECT is an environmentally and economically attractive innovation by experienced Swiss solar energy specialists. The feasibility of the project is given, and there are many possible and interesting implementation examples.

As representatives of the GOLDFISH PROJECT, we cordially invite all interested countries, cities, companies and organisations, as well as all interested private investors, to contact us regarding the further implementation of this project.

We hope that the GOLDFISH project will make the transition from dream to reality as soon as possible. In the interest of the increasingly scarce resources worldwide. Future generations will certainly be grateful for this.