Generation of Win-Win-Relations in the International Energy Market

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For improvement of technological infrastructure and enhancement of living conditions there is already a demand for the development of technical projects in certain parts and regions of threshold countries nowadays. This situation will become more and more important in the following 10 to 20 years and goes along with national as well as worldwide political declarations on sustainable usage of energy in combination with further development originated by globalisation.

Today a number of countries in Asia, Southamerica and Africa[1] are willing to improve the local conditions and are partners in the international field of energy related projects. After the economic crisis in the ASEAN states[2,3] in 1997 there is a promising recovery and the development of China, Thailand, Malaysia and India[4] is very strong. Countries in South-Africa as well as South-America are also very ambitious in further development of local regions. International operating organisation are present on site with financial support of developed countries.

Due to further development the energy demand of threshold countries will increase strongly. With the knowledge of today and severe efforts a small amount of this energy demand can be covered by ecological valuable projects combined with economical restrictions, which is the fundamental aspect of the here described project realisation. Using intelligent technologies matching to relevant conditions together with international cooperation will be a worthwhile strategy in the next decades.

The approach to projects with a chance for realisation in threshold countries especially in rural areas has to be completely different as it is known from technological developments for instance in Europe. The decentralisation of plants is the characteristic title. The economical point of view is changing totally and technologies have to be adapted to this. Not only the initial investment, also maintenance during operation and climate conditions for reliable operation has to be reconsidered. Therefore, severe partners with serious understanding for such tasks are necessary.

This paper describes the generation of win-win-relations between partners in threshold countries and developed countries by improvement of the energy and hygienic infrastructure realised in decentralised energy conversion projects. In order to create sustainable solutions renewable energy sources are preferred. In some cases local technology is available, which has been proven to operate reliable according to their ambient conditions. This technology will be completed in an overall energy concept by innovative technologies or at least know-how from developed countries such as for example heat driven refrigeration units for cold storage houses or desalination units for brackish or seawater conditioning using process heat from a cogeneration plant driven by biomass. Social and hygienic benefits are strongly combined with such concepts, resulting in a multi-effect project gain.

This approach is done by development of an international network concentrating on reliable project partners of threshold and developed countries respectively in order to define the certain demands of the individual project, available or already installed local technology as well as financial contributions from local governments or other institutions interested in investment in such multi-effect projects. Existing technologies have to proven in terms of economic qualification. In some cases it may be a strategy to develop joint ventures or even manufacturing in license in the destination countries.

These partners are also involved in the local approval process and the coordination on site. Partners of the network in developed countries are industrial and commercial companies and R&D facilities, which are interested in realisation of established or innovative technologies under relevant conditions required in threshold countries. Further partners are international operating financial institutions allowing the project realisation with different programs of support. During development and management of these projects an individual project group consisting of international partners is established equipped with an individual project contract.

Since the liberation of the energy market in some of the European countries has taken place so far, many efforts have been put into the development of decentralised energy units for production of electricity. Apart from that, engineers in different non European countries may have had the chance to improve certain technologies under continuous operation over a period of several years with a different understanding in quality of development and progress. This experience has been influencing the design process of technologies leading in certain cases to more reliable solutions compared to European systems.

Nevertheless, there are a lot of scientific projects in R&D-facilities, which are perfectly suited to the individual above described project conditions and ready to get into the market together with activities of innovative oriented companies. Very promising activities have been undertaken e.g. in the effective use of solar energy for the production of electricity and heat. Other approaches have been made for example in the field of small scale absorption or adsorption units, degasification units for the use of biomass and waste as well as effective, reliable and cheap systems for heat and cold storage applications or small scale units for water conditioning units. According to a different application focus especially the degasification could be developed to a convincing concept by developments undertaken in India[4]. A similar situation can be found in fuel conditioning systems for gas or dual fuel driven engines from cogeneration processes.

All these technologies are available to a distinct grade and some of them have been transformed or are already waiting for the transformation in suitable projects, which is given by the demands of the threshold countries.
The essential engineering aspect is the matching of the individual interfaces of single project components, so that a high efficient and reliable operating plant is created. Therefore the interfaces have to be determined very precisely and the optimisation of adaption requires detailed discussion with the technical partners of the project. Overall focus is the economic aspect of the individual project, so that a multiple contribution at further sites will be guaranteed.

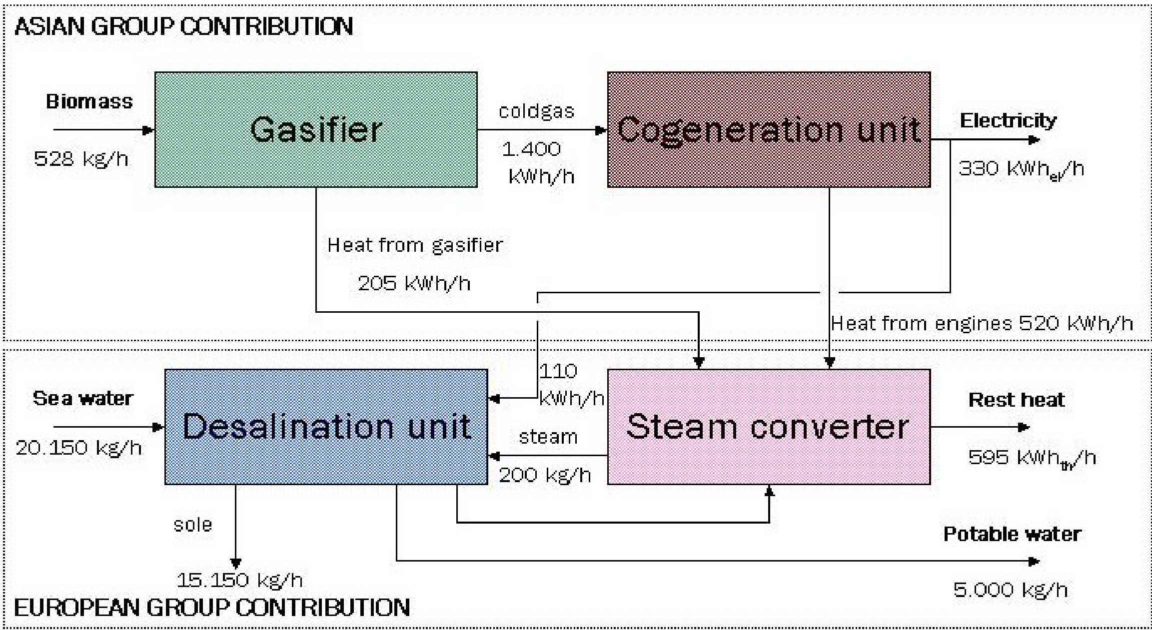

Figure 1: Flow sheet of a power and water plant

This contribution will describe the work in its single steps done so far at a project realised in Asia. The plant for the production of electricity (approx. 330 kWh/h) and potable water (approx. 120 m³/d) uses heat from a degasification unit and a cogeneration plant in the downstream, consisting out of two gas driven engines. Energy source for the degasification is biomass (approx. 530 kg/h), as shown in *Figure 1*. The equipment for the overall plant is a combination of technology from India and from Europe.

The gasifier has been developed and optimised in India[5]. In combination with gas driven engines the biomass gasification seems to be the most promising technology for providing affordable and competitive decentralised electricity supply and energy services to rural areas where agricultural and plantations wastes are available. The gasifier plant as shown in *Figure 2* consists of a reactor, which receives air and solid fuel. In the lower part of the reactor, the biomass feedstock undergoes drying and devolatilisation occurs in the upper zone producing char. The volatile matters undergo oxidation in the combustion zone, with air being partially drawn from the open top and partially supplied by air nozzles located after the devolatilisation zone. The gas then flow through a hot charcoal bed in which the tar produced earlier is burnt.
This specific effect enables the tar in the produced gas to be maintained at relatively low levels. With special washing and cleaning systems, which are developed as an integral part of the gasification system, the tar content is further reduced and allows particles in the cold gasstream at very low levels. Due to this principle, engines are enabled to run for long operating hours at maintenance efforts comparable to natural gas or diesel driven engines. The lower calorific value of the produced gas is about 4,5 to 5,0 MJ/kg. Compared to solid fuels the product gas allows much better control at different partial load conditions. Furthermore, the gaseous fuel increases efficiency and provides cleaner operation.

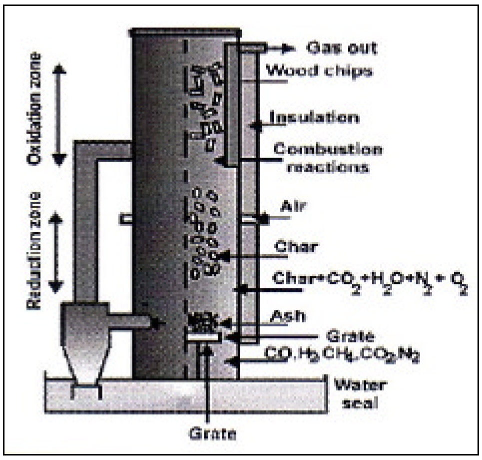

Figure 2: Gasifier plant for production of cold gas as fuel for dual or gas driven engines

The gas can be used in a diesel engine in the dual fuel mode and allows substitution of over 80% at nominal loads and 70 to 80% under part load conditions. A conventional gas driven engine can be operated at 100% produced gas with an additional air/fuel mixing and control unit.

Figure 3 shows the core principle of the thermal desalination unit, as it has been built for several applications already. These systems are available at lower production rates (< 5.000 m³/d) suitable for the named application and have low maintenance requirements.

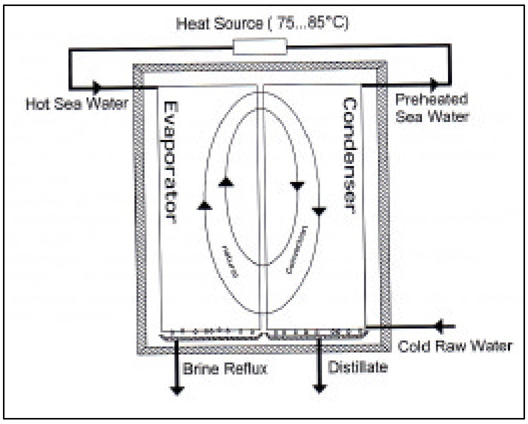

Figure 3: Evaporator/Condenser-Unit of the desalination apparatus

In combination with the gasification process and the usage of exhaust heat from the engines the temperature level of the saturated steam input as thermal source for the desalination should be about 122°C[7]. Steam and electric energy for the compression process is needed for desalination of sea or brackish water. At a distillation output of 120 m³/d the amount of sea water needed is approx. 20 m³/h with a higher concentrated sole output (brine reflux) of approx. 15 m³/h. Internal heat exchangers deliver distillate and sole at slightly higher temperatures as the ingoing seawater. Depending of the usage of the distillate this has to be conditioned afterwards with additional equipment to the required standards.

In the meantime the technical components are identified and the economical optimisation is necessary to gain affordable conditions at the destination. The above described principle can also be applied to processes for cold house storage tasks by integration of a smaller capacity absorption unit (200 to 500 kW_{cold}). It can be proposed, that in general these technologies can also be transferred to other destinations in other countries such as e.g. South-America or South-Africa as a trilateral model of cooperation in international networks.

In the next steps, further work has to be done in setting up conditions, which matches the individual situation in terms of economical and affordable claims. This process requires general understanding and the will to take additional efforts into account.

In conclusion, there is a high potential market for such projects in threshold countries, which gives the opportunity for the broad contribution of innovative technology in combination with existing technologies resulting in multi-effect project gains. These gains are the sustainable development of areas with lacking infrastructure and social demands by creation of employment together with improvement of the hygienic situation and other benefits consequently transforming renewable energy sources.

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