HIGH EFFICIENT MULTI-FUEL SOLAR HYBRID POWER PLANTS TO EASE THE ACCESS TO ENVIRONMENTAL FRIENDLY ENERGY IN REMOTE REGIONS – THE CASE OF INDONESIA

Witold-Roger Poganietz, Karlsruhe Institute of Technology (KIT), Institute for Technology Assessment and Systems Analysis (ITAS), Hermann-von-Helmholtz Platz 1, 76344 Eggenstein-Leopoldshafen, Germany, Phone: +49-(0)-721-608-28180, Fax: +49-(0)-721-608-26715, email: poganietz@kit.edu

Overview

One important impediment for the economic and social development of remote regions is a reliable access to energy, specifically to power. Due to this typically diesel generators are used. Although they are flexible and easy in handling, they are on the one hand rather inefficient, and on the other hand, damaging for the environment. In private households kerosene lamps are common. Kerosene lamps do provide mostly non healthy conditions to work and read after the sunset, which also hampers the education potentials of the people living in the respective regions.

Within an international project, a technological concept, in the following called SolComBio, is under development to overcome the impediments of local or regional power supply under environmental friendly and economic sound conditions. The concept makes use of the concentrated solar plant (CSP) technology and of a flexible biomass power plant technology, to lessen one of the main drawbacks of CSP technology. This is the providing of power only during daylight. The linking with a flexible biomass burner system could prolong the operation time of the CSP into the morning and evening hours and night time. The SolComBio technology is planned for 2 to 20 MW_e, i.e. mainly for local and regional purposes.

The aim of the presentation is to discuss the concept of SolComBio under the conditions of a specific remote region in Indonesia as a case study.

Methods

In a first step, a remote region is chosen, which fulfill the geographical and technological conditions of the concept, i.e. availability of sun light, biomass, as well as residual biomass, since one further aim of the concept is to ease the conflict between energy use of biomass and food.

In a second step the levelized costs of energy (LCOE) of SolComBio for the chosen remote region in Indonesia is calculated. The calculation considers specifically the market conditions for land, biomass supply and labor costs in the remote region. Additionally, to consider also environmental impacts of the concept, the external costs of SolComBio was included in the LCOE calculation.

In the last step, the calculated LCOE – with and without external costs – were compared with the LCOE – with and without external costs – of competing energy carriers under the conditions in the remote region in Indonesia.

Results

Comparing the LCOE of SolComBio without considering external costs, at the current state of the R&D efforts a market success cannot be expected. The LCOE per kWh of the new concept is above the current LCOE of competing energy carriers.

Fuel	LCOE (US$/kWh) (w/o external costs)	LCOE (US$/kWh) (with external costs)
SolComBio	0.60	0.61
Coal	0.29	0.38
Natural gas	0.30	0.31
Diesel	0.56	0.64
Gasoline (decentralized)	0.50	0.59

A main reason is that the still low overall efficiency of the technology.

A slightly different result can be stated, if the external costs are included in the calculations. SolComBio would be competitive with the currently mostly used energy carriers in Indonesia, i.e. diesel and gasoline. However, natural gas and coal have still lower LCOE.

Conclusions

The offered technology concept, which combines CSP technology with a flexible biomass burner system, seems to be not very successful at the current market conditions. The difference of the LCOE between the traditional energy carriers in Indonesia and SolComBio is noteworthy. The picture changes if external costs are considered. In that case, the LCOE of gasoline, diesel and SolComBio converge to a comparable level.

However, although the findings seem to be rather clear, some caveats are necessary to mention. SolComBio is a non-matured technology, i.e. a technology with potential high economies of scale, which could not be estimated at the current state of the development. Furthermore, although an overall scarcity of fossil energy carriers will affect the LCOE of SolComBio the impact should be lower, compared to fossil energy carrier using

technologies. Additionally, SolComBio lies of regional available energy carriers, reducing the logistic costs of power generation, as well as the building up a complex grid or the connection with the national grid, which especially expensive in a country like Indonesia.
Summing up, if the technological challenges could be overcome and by this, the overall efficiency could be increased, SolComBio seems to be an interest alternative to traditional power plant concepts, since it make use of locally available renewable energy carriers and it could be installed in remote regions with a considerable demand for power.

References

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