Briefing note on extended CSIRO-TERI partnership

Background

Currently there are two CSIRO – TERI ongoing projects in India, funded under the Asia Pacific Partnership for Clean Development and Climate (APP), namely:

1. Solar cooling for urban and remote rural applications
2. Accelerating the deployment of 'Smart Minigrids'

The two projects are managed by the Department of Environment, Water, Heritage and the Arts (DEWHA), Australia with co-funding from the Ministry of New and Renewable Energy (MNRE), Government of India.

The solar cooling project for remote rural applications aims to combine the sorption cooling expertise of CSIRO with the renewable energy expertise of TERI to develop and demonstrate solar cooling products appropriate to key Indian (and Australian) applications. The project aims to develop and test a zero emissions 15kW solar cooling system for remote rural applications in un-electrified areas of India. A biomass gasifier based gas engine generator will be used to supply backup heat for the solar cooling and overcome intermittency in the solar heat source besides supplying electricity to the village.

The 'smart minigrids' project will demonstrate reliability and efficiency of a renewable-energy powered stand alone electrical power system (known as a minigrid) in India and Australia and improve community, government and industry acceptance of the technology, thereby accelerating renewable and smart minigrid deployment in partner countries.

Objective

The supplementary support provided by AusAID would expand the scope and depth of two existing Asia Pacific Partnership (APP) funded projects being undertaken through a partnership between CSIRO and TERI. This would enable:

- An additional demonstration of refrigerated food storage using renewable energy in rural villages in India
- Monitoring of renewable electricity production and power distribution through a village level `smart minigrid'
- Provision of safe drinking water through the application of synergistic desalination technology

Expansion of the current projects will accelerate the deployment of essential services to rural communities in India, vastly improving their economic livelihood.

Rationale

In a tropical country like India, the importance of refrigeration can hardly be over-emphasized. 70% of the over 1.1 billion population of India is engaged in agriculture and the contribution of agricultural output amounts to 40% of the national income. The country is producing in excess of 60 million tonnes of fruits and vegetables per annum. While India's agricultural production base is quite strong, at the same time wastage of agricultural produce is massive. It is estimated that due to lack of proper storage and transit facilities, about 33% of the agricultural produce, especially fruits and vegetables, is spoiled. The wastage in fruits and vegetables is estimated to be about US$ 7.3 billion.

India and other developing countries which are predominantly agriculture-based economies have a tremendous growth potential with respect to rural-based food processing. However, poor infrastructure including lack of integrated cooling facilities (i.e. cold chains) has retarded the growth of the food processing industry. The Ministry of Food Processing in India has identified refrigeration and cold storages as the weakest link in the whole cold chain. The lack of proper storage facilities has led to the following consequences:

(i) Excess produce either floods the market and results in an oversupply or is totally wasted; and
(ii) An artificial scarcity is created during non-harvesting periods.

Farmers, the majority of which are marginal and small farmers, are forced to sell their produce immediately after its harvest at low prices primarily due to the lack of storage facilities. In spite of tremendous growth in this sector, the cold storage capacity has been unable to keep pace with the growth in production especially in rural and remote areas. The conventional cold storages which are being set up in urban and semi urban areas are of 100TR and above capacity making them unviable for small village level applications. Added to it is the problem of non availability of grid power in many rural areas in India, and indeed most developing countries.

Thus, it is essential to enhance cold storage capacity to meet the ever-growing need for storage of perishable produce and also to reduce wastage. There are a number of larger cold storage facilities available but their locations are generally not within the reach of marginal and remotely located farmers. Generally food production centres in many developing countries are situated in areas where the electrical power supply for the operation of conventional refrigeration plants is either unavailable or is erratic and unreliable. Thus, there exists an urgent need to develop a smaller capacity refrigeration system, which can be operated independently of grid electricity.

Up-scaling the solar cooling project will allow for the addition of field demonstrations and monitoring of both, (i) solar-biomass cold storage combined with electric power generation and (ii) electricity supply through `smart minigrid'. New work will also include demonstration of an alternative desiccant cooling approach for refrigerated food storage, including water desalination.

Socio-economic impacts

India faces twin challenges of poverty and unemployment in the rural areas. It is imperative, therefore, that the rural economy is improved, so the burden of poverty can be lessened and the working population can be absorbed in off-farm activities. The rural economy cannot be developed fully by improving only the productivity of agriculture. The economic status of this population can be improved by increasing non-farm activities, particularly rural food processing industries. Rural food processing industries not only establish linkages between agriculture and industry, they also improve the economic well-being of rural people by (a) increasing employment opportunities and (b) increasing their income; thereby preventing migration of rural population to cities.

As explained earlier, lack of proper cold storage facilities in rural areas is one of the major causes for wastage. This indicates huge loss of human efforts, and other resources. Moreover, in absence of proper storage of perishables, it is not possible to carry-out further processing of the produce. This in effect means that rural populace is denied decent livelihood opportunity by way of value addition to the raw produce. If proper storage is catered for, farm products could yield substantial amount of foreign exchange for a tropical country like India.

Besides providing cold storage facilities as a mean for rural economic development, the proposed system would also be providing electricity to the rural households and communities. The socio-economic impacts of this would be multifold, namely:

- Electricity for lighting, resulting in (a) clean environment, (b) increased hours for study and social interaction, and (c) improved quality of life
- Electricity for essential community applications like primary health centre and ICT based rural knowledge centres
- Electricity for commercial activities like village market place

- The use of electricity during the day time for income-enhancing activities like local entrepreneurship development and irrigated farming

The other benefit from the system would be in terms of the surplus heat, to be used for desalination, drying and other agro-industrial processes. Thus, the proposed system is conceptualized on the basis of holistic rural development, facilitating convergence of a variety of developmental activities.

Greenhouse Gas Savings Calculations

From practical experience in villages, the solar cooler would work typically for 300 days a year with 80% capacity factor, and considering the savings obtained by displacing diesel fuel with renewable solar and biomass energy sources, the following estimations can be made:

- 20,000 litres per year of diesel fuel savings from avoided electricity which would otherwise be required for conventional cooling
- 64,000 litres per year of diesel fuel savings from avoided electricity (192,000 kWh) which would otherwise be required for general purpose consumption in the village.

Consequently, the product would save around 84,000 litres of diesel per year per system. This equates to a greenhouse gas emission reduction of approximately 250 tonnes CO2 per system deployed.