

## Innovative green sectors

A third category of green economy solutions consists of so-called innovative green sectors. The sectors showcased here are able to substitute for fossil fuels and, in one case, can utilize waste flows. The sectors are:

- Biogas, which is a mixture of methane and carbon dioxide, can serve as a high-energy renewable fuel. Both liquid and solid wastes, e.g., palm oil mills

effluent (POME), may be used to produce biogas. This sector helps to solve a waste disposal problem while mitigating CO<sub>2</sub> emissions, and;

- Micro-hydro power, defined here as water-sourced electric power with capacity of less than 100 kw which is produced by generators placed in streams, is a clean energy source that consumes no natural resources, produces no emissions and generates no waste. It may be particularly appropriate for communities that are not currently connected to the national grid.

## Energy and biogas

Description	Industries generally look at waste as burdens for which they need to find solutions. However, with the right technologies, waste can be utilized as raw material for generating energy. Both liquid waste (e.g. dung, liquid manure and other bio-waste such as Palm Oil Mills Effluent (POME)) and solid wastes can be processed into gaseous fuels, which can in turn be used for energy generation, while avoiding the GHG emissions related to the use of fossil fuels. Biogas—a mixture of methane and carbon dioxide—is created during anaerobic fermentation of liquid wastes and serves as a high-energy, renewable fuel that can be used as a substitute for fossil fuels. High-quality fertilizer is a by-product of this process. Syngas is produced through gasification of solid wastes and can be likewise be used for rural electrification. Typically, one to two kg of solid waste can produce one kWh of electricity.
What is the issue?	The domestic energy demand of the HoB countries has been largely met through fossil fuels in the last few decades, notably oil, coal and, more recently, natural gas. Energy use is the second largest source of GHG emissions, following emissions from land use changes, including deforestation and peat fires. It is also one of the fastest growing sectors. In the HoB, many communities are not connected to the national grid, instead getting their electricity from generators which run on fossil fuels. The fuel has to be bought and transported from the cities. Furthermore, waste from palm oil mills and plantations is abundantly available in the HoB and can be part of a comprehensive solution to a complex waste problem, combining regulatory implementation, industrial burden, energy conservation, community income, standard of living, regional economy and environmental protection.
Who is the seller?	Many combinations can be envisioned depending on the business model.
Who is the buyer?	Many combinations can be envisioned depending on the business model.
Steps towards successful business model:	<ul style="list-style-type: none"> <li>• Stricter law enforcement on waste handling policy;</li> <li>• Incentivize companies to partner with specialized waste handling companies to handle waste in accordance with regulation;</li> <li>• Technology provider offers comprehensive solutions;</li> <li>• Developer/investor commences commercial piloting and conducts capacity building;</li> <li>• Community seizes opportunity of conducting business as small power producer cooperative, or as waste/raw material logistics cooperative.</li> </ul>
What can Banks/investors do?	Financial institutions can channel 'green and clean' energy funding into appropriate technology initiatives.
What can the private sector do?	<ul style="list-style-type: none"> <li>• Abide by waste handling regulations;</li> <li>• Piloting and building capacity in local communities;</li> <li>• Establish corporate social responsibility (CSR) program to channel result of waste processing initiative for the benefit of community.</li> </ul>
What can the Government do?	<ul style="list-style-type: none"> <li>• Stricter enforcement of regulations;</li> <li>• Awareness raising about available renewable energy incentives.</li> </ul>
Contribution to ...	<ul style="list-style-type: none"> <li>• Securing natural capital: Finding solutions to waste problems in the HoB (including effluent from palm oil plantations and mining) contributes directly to improvement of natural capital.</li> <li>• Poverty reduction: The poor can benefit from these green solutions through rural electrification and income-generating opportunities; their quality of life is also enhanced through better environmental quality.</li> <li>• Economic growth: Both industries and local communities enjoy new economic opportunities.</li> <li>• Climate change: Providing green alternatives to energy generation directly mitigates emissions.</li> </ul>

## Micro-hydro power

Description	Micro-hydro power is water-sourced electric power with capacity of less than 100kw from generators that are placed in a small stream. The power of the stream is harnessed by installing a water wheel that, when turned, feeds a power generator. Micro-hydro power generation is a clean, sustainable energy source that consumes no natural resources, produces no emissions and creates zero waste. It can provide electricity on a modest scale.
What is the issue?	Many communities in the HoB are currently not connected to the national grid and get their electricity from generators which run on fossil fuels. The fuel has to be bought and transported from the cities. Their access to energy could be improved through micro-hydro initiatives. Due to its modest scale, the problems encountered with big dams, such as loss of biological diversity and habitats, disruption of migration routes, and a host of social problems such as involuntary relocation and loss of livelihoods are avoided. Big dams, however, can provide energy beyond the local needs and provides industries with 'GHG-free' energy. Micro-hydro initiatives therefore cannot substitute for big dams to meet industrial demand, but can be useful in supplying electricity to entire villages.
Who is the seller?	To date there is no trade in electricity generated from the micro-hydro stations in the HoB. Based on village meetings, electricity is distributed to each household and public facilities (e.g. hospital, government's offices, etc.). Each household is requested to make a modest financial contribution for cable network maintenance, engine maintenance, etc.
Who is the buyer?	Thus far, there has been no trade in electricity, but there are some potential buyers (i.e. local businesses, government, etc.).
Steps towards successful business model:	<ul style="list-style-type: none"> <li>• Undertake feasibility study;</li> <li>• Community organizes itself for management and maintenance of the micro-hydro power generator (MHPG) and protects the intake forest for sustainability of the water supply;</li> <li>• Develop standard operating procedures;</li> <li>• Develop business model including tariff of electricity supplied and price for household and business buyers;</li> <li>• Develop local regulation for MHPG maintenance and related management issues, including conservation regulation for protecting water catchment area;</li> <li>• Maximize the utilization of installed capacity by developing or stimulating small-scale business within community.</li> </ul>
What can Banks/investors do?	Channel green and clean energy funding into appropriate green energy initiatives.
What can the private sector do?	<ul style="list-style-type: none"> <li>• Support micro-hydro initiatives with technical skill and managerial knowledge;</li> <li>• Use MHPG as part of CSR program;</li> <li>• Implement environmentally-friendly practices to maintain catchment area.</li> </ul>
What can the Government do?	<p>National:</p> <ul style="list-style-type: none"> <li>• Raise awareness about the current renewable energy incentives available under national policies.</li> </ul> <p>Local:</p> <ul style="list-style-type: none"> <li>• Facilitate connections between communities and institutions mandated to work on rural electrification and green energy promotion.</li> </ul>
Contribution to...	<ul style="list-style-type: none"> <li>• Securing natural capital: Forests surrounding the stream are properly managed to secure water for the power station, reducing the threat of deforestation. Trees are no longer cut down to meet the village's fuel needs.</li> <li>• Poverty reduction: With no need to buy diesel to power their generators, the cost of living has decreased. This money can now be spent on health and education measures, etc. Reliable electricity supply for lighting needs, cooking utensils and other appliances improves day-to-day standard of living.</li> <li>• Economic growth: Electricity, e.g. through lighting and the use of appliances, can free up time to engage in income-generating activities.</li> <li>• Climate change mitigation/adaptation: Though the conservation of forest, but most importantly through substituting conventional energy sources with a green alternative, GHG emissions are mitigated.</li> </ul>