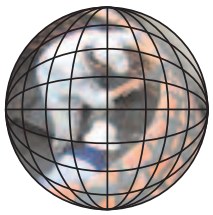

Biogas technology is already working extremely well on a large scale in several Asian countries. Wim J. van Nes reports on some of these successes and recent upscaling initiatives, and makes a plea for a global conference on biogas.

Asia hits the gas

Biogas from anaerobic digestion rolls out across Asia

Production of biogas through anaerobic digestion is a relatively simple carbon reducing technology that can be implemented at commercial, village and household scales. It allows for the controlled management of large amounts of animal dung and the safe production of gas for cooking, lighting or power generation (Figure 1). In addition, as a by-product, it provides an extremely valuable agricultural fertilizer. The use of household biogas is most widespread in Asia. In China, over 15 million households use biogas, and successful programmes have been established in Nepal and Vietnam. An international seminar on biogas technology held in Beijing, China, in October 2005 perfectly illustrated the renewed interest shown in the application of anaerobic digestion in this part of the world. Now moves are afoot to roll out biogas programmes right across Asia, with the Netherlands Development Organization (SNV) taking an important role.

INTERNATIONAL SEMINAR ON BIOGAS

The UN Asian and Pacific Centre for Agricultural Engineering and Machinery (UN/APCAEM) and the Centre for Energy and Environmental Protection Technology Development (CEEPTD) of the Department of Education, Science and Technology of the Chinese Ministry of Agriculture jointly organized an International Seminar on Biogas Technology for Poverty Reduction and Sustainable Development in Beijing, China, from 17–20 October 2005. This seminar was attended by more than 160 participants, out of which about 100 were from China. Others came from Vietnam, Cambodia, Nepal, Bangladesh, Lao PDR, Mongolia, Indonesia, Bhutan, Lesotho, USA, Germany and the Netherlands. During two days, a total of 26 presentations were delivered.[1,2] Twelve focused on domestic biogas systems, and 14 provided information on biogas in China. The presentations made at this conference form the basis for much of the information in this article.

SUCCESS STORIES

China

In 2000, China's Ministry of Agriculture started to introduce various technologies into rural areas, introducing new policies such as 'Ecological Homeland' and 'Plan to Enrich People'. A domestic biogas plant forms the base, combined with other 'transformations' that are dependent on local conditions. These include pig farming as well as the construction of toilets, kitchens, solar-heated greenhouses, orchards and cisterns. Investment subsidies for biogas plants from the central government depend on the level of regional economic development.

According to Wang Jiuchen, the Director of Energy Ecology Division, Department of Science and Education of the Chinese Ministry of Agriculture, 15 million households in China were using biogas by the end of 2004. The Ministry aims to increase this number to 27 million by 2010, which will account for over 10% of all rural households. By the end of 2005 there were 2492 medium and large-scale biogas digesters in livestock and poultry farms, while 137,000 biogas tanks had been constructed for the purification of household wastewater.

> 15 million households in China were using biogas by the end of 2004

In Sichuan Province alone, 2.58 million domestic biogas plants had been constructed by the end of 2004. This number will be increased to 5 million by the end of 2010. The price per system is between 1200 and 1500 RMB (€120–150), while the government subsidy ranges from 800 to 1000 RMB (€80–100).

In order to help this growth the new Renewable Energy Law of the People's Republic of China came into force on

Building a biogas digester in Vietnam ALL IMAGES SNV

1 January 2006, following its approval in 2005. This law establishes five systems to support the development of renewable energy resources – market fostering and protection; resource exploitation and planning; technical and industrial support; price support and cost sharing; and financial support and economic stimulation.

To promote the use of biogas, various steps are being taken to industrialize the construction of biogas plants. One example is the so-called Puxin Biogas Plant developed by Shenzhen Puxin Science and Technology Co. Ltd.[4] This plant is equipped with a glass-fibre-reinforced plastic gasholder to shorten the construction period and to avoid possible gas leakages through brick or concrete domes. However the Puxin Plant is more expensive than conventional plants, meaning that it will mainly be used when the quality of the builders who would be employed to make a traditional masonry or concrete dome gastight cannot be guaranteed.

Another company, the Anhui Chizhou Xingye Natural Energy Developmental Co. Ltd. in Anhui Province, is producing a pre-fabricated fibreglass biogas plant in six pieces. It began production in 2002 and now claims to have a manufacturing capacity of 35,000 units per year. The retail cost of this 'Anhui' plant is low, about €135, while an additional €45 is required for the installation of the plant taking normally two days. The lifetime of an Anhui plant constantly in contact with biogas is still to be established.

India

In India, the Ministry of Non-Conventional Energy Sources (MNES)[5] continues to implement the National Biogas and Manure Management Programme (NBMMP) through State nodal departments and agencies, the Khadi and Village Industries Commission (KVIC) and a number of NGOs. Several

HUBEI PROVINCE CASE STUDY

Ms Zhao Lixin from the Centre for Energy and Environmental Protection Technology and Development (CEEPTD) (ceeptd@china.com)[3] presented the results of a case study on the economic benefits of domestic biogas plants in Shipai Village in Jianshi County of Hubei Province. The altitude of this village is 900 metres, with an average temperature of 12ºC. More than 90% of a total of 227 households have installed a 10 m^3 biogas unit. The village was also engaged in pig raising and the promotion of pollution-free green food crops. The gas produced per household on a daily basis amounted to 1.0–1.2 m^3, which was used for both lighting (1.0–1.5 hours per day) and cooking. This saved electricity (RMB 10 per year) (€1) and coal (RMB 136 per year). Use of digested slurry saved on chemical fertilizer (RMB 118 per year) and pesticides (RMB 19 per year). The annual benefits from raising an increased number of pigs (RMB 164 per year) and saving of labour (RMB 186) were also substantial. In addition, social benefits were realized, such as employment for technicians, improvement of health, and increased participation in social work by women.

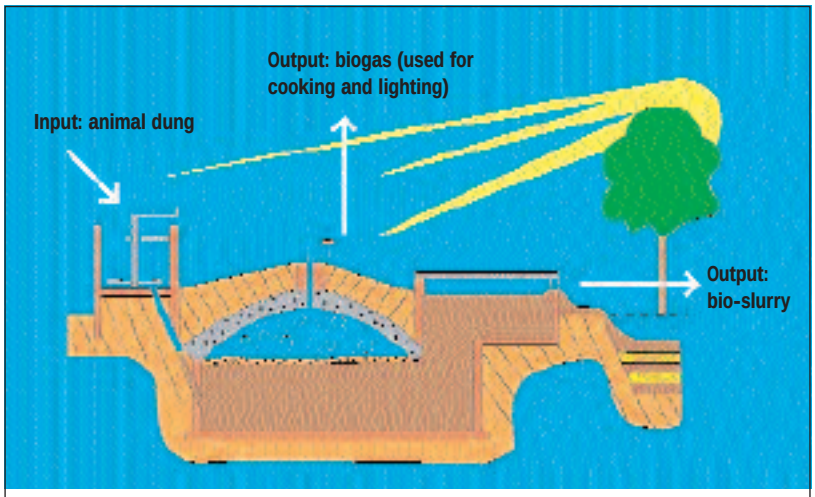

FIGURE 1. **Diagram of working biogas plant. Source: SNV**

grass-root level voluntary agencies and self-employed trained workers are also being involved by these agencies in promoting and constructing biogas plants as well as providing maintenance services. MNES provides financial assistance for the construction and maintenance of biogas plants, training and awareness creation, technical centres, and service charges or salary support to implementing agencies. Against an estimated potential of 12 million domestic biogas plants in the country, a total number of 3.67 million biogas units had been installed by the end of fiscal year 2004.[6] Construction rates in the most recent years have been falling from their peak of 200,000 plants per annum. During financial year 2004–2005, the Regional Offices of the Ministry have conducted inspections of 3825 biogas plants installed over the last three years. Out of these, 93% were found to be functional.

In India, no less than 3.67 million biogas units had been installed by the end of fiscal year 2004

Biogas appliances produced by one of the 15 manufacturers in Nepal

Biogas production can also be installed in combination with sanitation. Public toilets incorporating biogas units are particularly suitable for peri-urban areas and small towns in India where the supply of cooking gas is inadequate and waste water treatment is unaffordable for the local authorities. According to Dr P.K. Jha from Sulabh International Social Service Organization,[8] his organization has constructed about 1.2 million household toilets and more than 6000 community toilet complexes. Yet only about 150 of these community complexes (2.5%) include a biogas digester.This is mainly because the local bodies that provide funding are normally not aware of the importance of biogas systems and opt out of habit for a septic tank system.

Biogas systems can become part of decentralized wastewater treatment, as demonstrated by a community-based sanitation project in Ullalu, an urban slum in Bangalore, India. Ms Susmita Sinha[9] from the Bremen Overseas Research and Development Agency (BORDA) explained that hot water for bathing and lighting of the toilet complexes at night-are the two major improvements to existing facilities. Limitations for community based sanitation installations are the lack of skilled labour for construction, non-availability of pre-fabricated units and complex maintenance for the operation of these units. The potential for increasing the deployment of these systems is yet to be established.

Biogas Support Programme in Nepal

Despite the continuing insecurity in Nepal caused by clashes between the government and Maoist insurgents, Nepal's Biogas Support Programme (BSP) still succeeds in delivering quality biogas plants, though the numbers are lower than planned. In the Nepalese fiscal year 2004–2005, 17,803 domestic biogas plants were installed, bringing the total number installed under the BSP since 1992 to over 140,000. The involvement of the private sector is one of the main factors for this success. Mr S. Bajgain[10] from Biogas Sector Partnership recently highlighted the strengths and weaknesses of the private sector's involvement in BSP, reporting that 62 biogas construction companies have been established, along with 15 workshops for the manufacturing of biogas appliances and about 140 micro-finance institutes involved in biogas lending in rural areas.

The involvement of the private sector has not only managed to increase the biogas market, but has also maintained the quality standards established by the BSP. However it is also responsible for the lack of long-term vision and planning, sometimes resulting in unhealthy competition and lack of initiative to operate in more remote areas.

The BSP has convincingly demonstrated that biogas technology positively affects the lives of farmers, especially women and children, in rural areas. The social and environmental conditions of about 800,000 people have been improved, making the BSP a good example of a successfully scaled up technology.

There are several key lessons and necessities which can be learned from Nepal's biogas programme.[11] These include:

- the need to adapt the product to the needs and concerns of the end-user and market. Important feedback from the users and their neighbours was obtained through periodic quality checks and surveys and used to assess impacts and improve product and services.
- establishing and enforcing design, quality and service criteria to ensure the reliability and cost-effective operation of installed systems. A tight relationship was maintained between the disbursement of subsidies and the required standards for the biogas systems, thereby ensuring a quality control on all aspects of the production and delivery cycle.
- identifying the key institutional partners and strengthening the capacity of these players to effectively carry out their respective roles. Specifically, the programme has worked in association with the Alternate Energy Promotion Centre (AEPC) in Nepal to secure government and donor support from the Netherlands (DGIS) and Germany (KfW) and to further promote the use of biogas in Nepal. It has worked in partnership with micro-finance and banking institutions both internationally and domestically to design and implement affordable consumer credit schemes affording rural farmers to purchase biogas systems. BSP worked very closely with the private sector biogas construction companies and biogas appliance vendors, providing them with technical and management training to ensure that these firms were able to meet the strict standards, control costs and increase production capacity with the growing demands for biogas. Collaboration with various NGOs was maintained to promote the dissemination of biogas. Most recently, an application for registration was successfully submitted to the Clean Development Mechanism (CDM) Executive Board for the CER credits associated with the biogas programme in Nepal.

In recognition of the success of the Nepal Biogas Programme, BSP-Nepal, the independent Nepali NGO originating from the SNV's programme office,[12] received the prestigious Ashden Award for its promotion of sustainable development. The prize of £30,000 (€44,000) will be used to experiment with new types of biogas plants at high altitudes in the Himalaya.[13]

Satisfied biogas user in Bangladesh

BENEFITS OF BIOGAS FERTILIZER

The residue of the biogas production process is a valuable fertilizer, which can be more beneficial than other fertilizers. In Beijing, Mr Vasudeo of NARDEP – an NGO from Tamil Nadu, India – explained the importance of biogas manure in supplying nutrients, enhancing water-holding capacity of soil, soil aeration, accelerating root growth and inhibiting germination of weed seed. He presented several case studies comparing the superior effect of biogas fertilizer with that of other fertilizers on the production of crops such as maize, tomatoes, coconut trees and lemon trees. He also recommended the use of non-edible oil cakes – for example Jathropha and Neem – as feedstock for biogas plants for rural households unable to collect sufficient (cattle) manure.[7]

SCALING UP – ASIA BIOGAS PROGRAMME

Based on the successful results in Nepal and encouraging signs from Vietnam (see below), the Board of Directors of SNV decided to launch an initiative for increasing the biogas markets in Asia.

The main objective of SNV's biogas activities is to support the long-term development of sustainable national programmes for the promotion of domestic biogas in a number of developing countries. A first screening of countries is made on the basis of pre-conditions for large-scale dissemination of biogas plants. If the major pre-conditions are met, SNV undertakes fact-finding missions and feasibility studies in order to make a well founded 'go–no go' decision for intervention. These missions and studies include comprehensive context and multi-stakeholder analyses. In case of a 'go' decision, a detailed proposal for a national programme including output targets, estimated expenditures and proposed financing is formulated in cooperation with the different (potential) partners. SNV aims to involve a maximum of organizational and institutional capacities already available in the country and to strengthen these capacities rather than keep the implementation of activities in its own hands.

National programmes require multiple actors to conduct distinguished functions in a co-ordinated manner (Figure 2). SNV aims to support the development of the biogas sector as a whole, and therefore all actors in the sector are potential partners. The focus of support might shift, depending on the needs of the programme and the capacity of the involved organizations at a certain moment in time. In the end, SNV hopes to see a fully developed sector in which livestock farmers purchase biogas plants and acquire micro-credit to finance the installation of biogas plants on a commercial basis. Producers of biogas plants and credit institutions compete with each other on a level playing field with an agreed set of quality standards.

Through the Asia Biogas Programme, SNV aims to reach about 210,000 households through installation of a same number of biogas plants, covering about 1.3 million people, in selected countries in Asia.

Several potential problems need to be avoided however if the programme is to be a success. These have been identified as the potential lack of product reliability (quality

management), lack of appropriate credit facilities, lack of willingness among suppliers to co-operate and to compete, lack of organizational sustainability, lack of financial sustainability; unsuitability of CDM for national biogas programmes; and decreasing availability of animal dung.

Biogas project in Vietnam

The market potential for domestic biogas in Vietnam is large. The country's animal husbandry sector is vibrant, expanding and for the large part managed in family farms. Farmers and government are keen to reduce the environmental load of the sector, and embrace solutions such as biogas plants. Alternatives to inefficient conventional domestic fuel sources are welcomed, as are opportunities to improve the nutrient management of the fields. With a rural population that is accessible and well educated, awareness travels fast. Out of the technical potential of 2 million installations, an active demand of 1 million domestic biogas plants seems a realistic estimate.

At the recent conference in Beijing Mr F. ter Heegde from SNV delivered a presentation on the Biogas Project (BP) in Vietnam.[14]

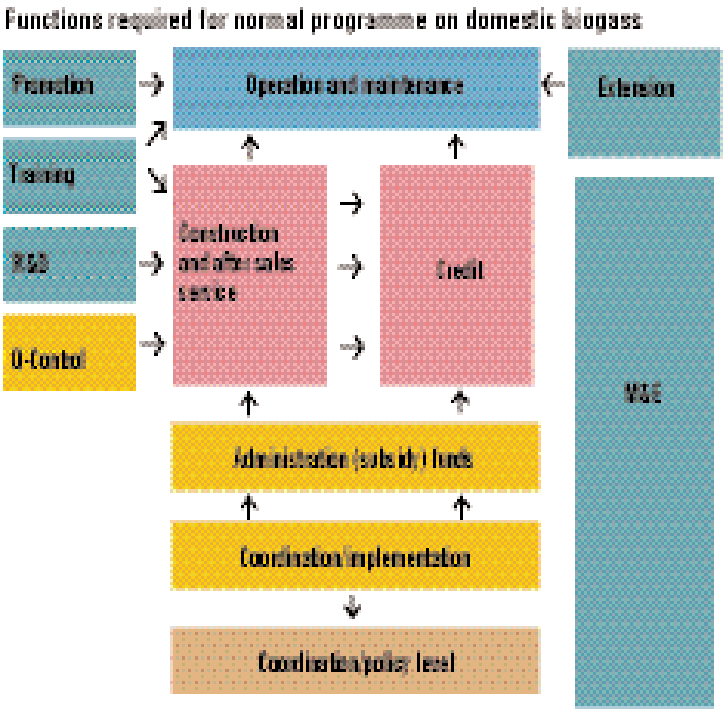

FIGURE 2. **Functions required to be executed in a national programme on domestic biogas. Source: SNV**

In January 2003, the Vietnamese and Netherlands governments signed a memorandum of understanding (MoU) for the implementation of the Biogas Project (BP), a domestic biogas dissemination project in 10 of Vietnam's 64 provinces.[15] This project combines Vietnam's technical knowledge on plant design and construction with SNV's experience with large-scale dissemination of domestic biogas. The Netherlands' Directorate General for International Co-operation (DGIS) is supporting the project financially with an initial grant of US$2 million. The combination has so far proved successful – at an early stage the project expanded to two additional provinces and increased its quota from 10,000 to 12,000 biogas plants. In July 2005, six months ahead of schedule, the project reached this goal. In anticipation of a second phase, the Netherlands has agreed to increase its grant to fund an additional 6000 installations, thus bringing the project target to 18,000 biogas plants by the end of January 2006.

Encouraged by these results, the Vietnamese Department of Agriculture at the Ministry of Agriculture and Rural Development (MARD/DA) and SNV agreed on the joint development of a second nationwide phase for the biogas programme. This second phase aims to support construction of 180,000 domestic biogas plants in 58 provinces of Vietnam over a period of 5 years. The programme plans to start in February 2006, allowing a smooth transfer from phase 1.

The second phase of the programme seeks to ignite a lasting market and consumer demand for domestic biogas plants and to encourage high quality services to meet this demand. Some of its key components will include:

- Building on past successes and lessons
- Creating a commercially viable sector
- Jump-starting provinces: Over a period of 5 years, the

programme will assist provinces to establish the full infrastructure necessary to support a market oriented biogas sector
- Decentralized biogas-training centres: The programme intends to support the establishment of three biogas training centres over the country.
- Maximization of biogas benefits: BP II will put a renewed emphasis on the varied benefits of biogas. This will be done by continuing research into slurry use, targeting disadvantaged households, improving stoves and other related technology, promoting the intangible (social) benefits, assessing the impact of biogas on women's lives and building on the benefits.
- Innovative financing mechanisms.

The total investment available for the programme is around €66 million. The proposed financing scheme includes private investment contributions by the beneficiary, investment credit and investment subsidies, development and government loan combined with CDM revenue, and an ODA grant.

National Domestic Biogas and Manure Programme in Bangladesh

So far, the Bangladesh Council of Scientific and Industrial Research (BCSIR) and the Local Government Engineering Department (LGED) have been the main actors in the dissemination of biogas plants. In total, close to 24,000 domestic biogas plants of different designs have been installed throughout the country. The fixed dome model has become the most popular design. Yet due to expiration of projects, the installation of biogas plants has come to an almost complete standstill since June 2004. Only Grameen Shakti continues to install biogas plants, around 100 in 2005.

In March 2005, SNV conducted a study into the feasibility of a national programme for domestic biogas in Bangladesh, concluding that such a programme would be feasible as Bangladesh has already a rich history of domestic biogas and has the necessary organizational and institutional capacities.[16] In addition, the technical potential is at least one million units and the financial analysis of an average plant is positive. As the actual price of non-renewable biomass replaced by biogas varies greatly, an effective micro-credit facility however will be required. Finally, there is a clear will and interest among (potential) stakeholders to be engaged in a national biogas programme.

In July 2005, an implementing partner was chosen in close co-operation with all stakeholders – the Infrastructure Development Company Ltd (IDCOL). Under the biogas programme a total of 36,450 plants are targeted to be installed between 2006–2009. Several activities will be implemented to achieve this target. Promotion and subsidy administration will be one of the activities in which Taka 7000 (€90) will be provided as subsidy.

Similarly, construction of high quality plants will be ensured by enforcing parameters of quality standard and quality control system. To ensure proper functioning of the plant, guarantees on plants and maintenance services will be provided for 3 years and training on operation and maintenance will be provided to each user. To optimize the use of biogas regular applied research and development activities will be carried out. Staff of the partner organizations will receive training to

BIOGAS SAVES RESOURCES

The annual benefits for the average biogas household in Nepal are savings of the use of firewood (2 tonnes), of agricultural residues (1 tonne), of dried dung (250 kg), of kerosene (70 kg) and of chemical fertilizer (39 kg of nitrogen, 19 kg of phosphorous and 39 kg of potassium). In addition, health benefits are realized through reduced indoor air pollution and attachment of a toilet to the biogas plant in 72% of all biogas households. BSP is generating direct employment for 11,000 persons, saves time (average of 3 hours per day per household) especially for women and children and helps reducing deforestation and greenhouse gas emissions.

enable them to manage, operate and maintain the installed biogas plants effectively and efficiently. Similarly, proper utilization of bio-slurry will be given high emphasis.

IDCOL will implement the programme by establishing a biogas programme office with the involvement of several capable partners. These partners could be biogas plant installers, finance institutions, NGOs, Governmental departments and private consultants. The total budget of the programme amounts to about €15 million.

Biodigester support programme in Cambodia

Compared with Bangladesh, the history of biogas in Cambodia is rather limited. About 400 low-cost plastic tube digesters have been installed by various organizations such as Cel-Agrid of the University of Tropical Agriculture, the Cambodian Rural Development Team (CRDT) and the FAO-Telefood programme. A recent survey by GERES-Cambodia among 55 biogas farmers in the provinces of Kampong Cham, Takeo and Kandal showed that about half of them (26 systems) were not in operation.[17] The average lifetime of a plastic tube digester was found to be only around two years, with proper fencing and roofing being identified as factors that may improve the durability of such systems.

In January 2005, a study on the feasibility of a biodigester support programme in Cambodia was concluded positively.[18] It was decided to focus first on six of Cambodia's 24 provinces. The technical potential in these six provinces was conservatively estimated to be over 220,000 units. In May 2005, a memorandum of understanding was signed between SNV and the Cambodian Ministry of Agriculture, Forestry and Fisheries (MAFF) on technical assistance for a national biodigester programme. The target for the number of biogas plants to be constructed between 2006–2009 is 17,500. Targeted households are those keeping livestock and producing 20–100 kg of dung per day. In addition, the programme will hope to speed up the development of a commercially viable and market oriented biogas sector. Efforts will also be undertaken to launch a biogas credit facility through Tahneakea Phum (Cambodia) Ltd. (TPC), a micro-finance institute specializing in agro-credit, and the bank ACLEDA. The Netherlands Development Finance Company (FMO) is a shareholder of both TPC and ACLEDA Bank and may be willing, if required, to strengthen these institutes through capital or services. A permanent technical training centre will be established at the premises of the polytechnic institute Preah Kossamak (PK).

> Carbon finance could provide a real opportunity for reinvigorating the uptake and commercialization of biogas systems

CDM AS FINANCING INSTRUMENT

The potential of CDM financing for domestic biogas has been significantly reduced following the decision of the Executive Board (EB) in November 2005 to remove from the small-scale CDM methodologies the reference to projects that replace non-renewable biomass. This was done to avoid double accounting of carbon stocks and carbon pools and the difficulty in proving that the biomass used is non-renewable. The CDM projects affected by this decision are all small-scale renewable energy programmes aiming to provide access to sustainable energy for households.

The EB requested submissions by 5 December 2005 of alternative methods for calculating emission reductions for small-scale project activities that propose the switch from non-renewable to renewable biomass, while not accounting for any net increase of carbon pools compared to what would occur in the absence of the project activity.

As of October 2005, 26 Project Design Documents (PDDs) relating to biogas on large-scale pig farms in Latin America (Brazil, Mexico, Chile) had been submitted for validation along with seven PDDs related to medium-scale pig and dairy farms (Philippines, Mexico) and one PDD relating to 5500 domestic biogas plants fed by cattle dung (India). More recently, two PDDs relating to domestic biogas in Nepal were validated and registered by the Executive Board of CDM on 27 December 2005. For small-scale biogas programmes, high transaction cost remains a barrier as the inflexible bundling rules will make the CDM project unattractive to investors. At the recent Beijing conference, Dr Jason Yapp from UK-based consultancy Caleb Management Services Ltd. concluded that once the barriers and risks are properly identified, carbon finance could provide a real opportunity for reinvigorating the uptake and commercialization of biogas systems. He recommended exploring the feasibility of developing CDM projects based on sector-orientated policies in order to reduce transaction costs, addressing the additionality issues as well.

CONCLUSION

For several years now renewed efforts have been undertaken for the scaling-up and market development of domestic level biogas projects in Asia, especially in China, Nepal, Vietnam and the Indian subcontinent. It is most unfortunate that the reference to projects that replace non-renewable biomass has been removed from the small-scale CDM methodologies. Hopefully, alternative methods for calculating emission reductions for small-scale project activities that propose the switch from non-renewable to renewable biomass will be

become available soon, as this will increase the potential of CDM to aid the commercial development of domestic biogas. After the successful regional Biogas Seminar in Beijing, it is time start organising a world-wide biogas conference, more than 15 years after the international biogas conference in Pune, India, in 1990.

Wim J. van Nes is the Biogas Practice Team Coordinator of the Netherlands Development Organization (SNV)
e-mail: nesvliet04@yahoo.co.uk

English language papers of the Biogas Seminar in Beijing are available from UNAPCAEM at www.anapcaem.org

NOTES AND REFERENCES

1. Ministry of Agriculture, P.R. China, and Economic and Social Commission for Asia and the Pacific, UN, *Conference Handbook, International Seminar on Biogas Technology for Poverty Reduction and Sustainable Development.* Beijing, China, 17-20 October, 2005.
2. Centre for Energy and Environmental Protection Technology Development, Ministry of Agriculture, and Asian and Pacific Centre for Agricultural Engineering and Machinery, UN, *Conference Proceedings, International Seminar on Biogas Technology for Poverty Reduction and Sustainable Development.* Beijing, China, 17-20 October, 2005.
3. Centre for Energy and Environmental Protection Technology and Development (CEEPTD)(email:ceeptd@china.com)
4. Shenzhen Puxin Science and Technology Co. Ltd (www.topsaving.com)
5. Ministry of Non-Conventional Energy Sources (MNES, www.mnes.nic.in)
6. Ministry of Non-Conventional Energy Sources of the Government of India, *Annual Report 2004-2005.* New Delhi, India, undated.
7. Mr Vasudeo of NARDEP (Ngc_vknardep@sancharnet.in)
8. Dr P.K. Jha from Sulabh International Social Service Organization (sulabhpkja@vsnl.net)
9. Ms Susmita Sinha from BORDA (sumisinha@yahoo.com)
10. Mr S. Bajgain (sundar_bspnepal@yahoo.com)
11. Sundar Bajgain and Indira (Sthapit) Shakya, edited by Matthew S. Mendis, *The Nepal Biogas Support Program: A Successful Model of Public Private Partnership for Rural Household Energy Supply.* Ministry of Foreign Affairs of the Netherlands, SNV Netherlands Development Organization, Biogas Sector Partnership – Nepal, Kathmandu, 2005.
12. www.bspnepal.org.np
13. A Memorandum of Understanding (MoU) on this initiative was signed in December 2004 between SNV and the Dutch Minister for Development Cooperation during the Energy for Development Conference in the Netherlands. The financial contribution by DGIS to the Asia Biogas Programme amounts to 12.9 million for the period 2005 up to 2011. (www.snvworld.org, see 'Biogas' under 'Practice Areas').
14. Mr F. ter Heegde from SNV (fterheegde@snvworld.org)
15 The Vietnamese Biogas Project (www.biogas.org.vn).
16. Wim J. van Nes, Willem Boers and Khurseed-Ul-Islam, *Feasibility of a national programme on domestic biogas in Bangladesh. Final Report.* Netherlands Development Organization, the Netherlands, August 2005.
17. E.R. van Mansvelt, *Survey of plastic biogas digesters in Cambodia.* GERES-Cambodia, Phnom Penh, December 2005.
18. Jan Lam and Willem Boers, *Report on the Feasibility Study for a Biodigester Support Programme in the Kingdom of Cambodia.* Netherlands Development Organization, January 2005.

■ To comment on this article or to see related features from our archive, go to **www.renewable-energy-world.com** and click the 'Forum' tab.