TECHNOLOGY AND COMMUNITY DEVELOPMENT BCD 216

LECTURE 10

DETERMINING A SUSTAINABLE APPROACH (CONT'D)

1) City construction

The city's layout - urban planning - greatly affects the usefulness and appropriateness of technologies. For example, transport: Medium to high density development enables an emphasis on walking, cycling and public transit, all of which rely less on complex and expensive technology, as well as having a lower impact on the environment, and allowing a greater quality of life for residents. An emphasis on vertical development (medium to high buildings) reduces the land area used by buildings, leaving more open green space while maintaining the medium to high density needed for sustainable settlements. In the developing world, cities are expanding rapidly, often along an ad hoc, car-dominated model. Changing this direction is essential for both sustainability and for creating desirable cities.

2) Building construction

Building methods regarded as appropriate technology include: rammed earth, Adobe and Super Adobe, compressed earth block, dutch brick, animal products, earthship, etc. other green building materials could be considered appropriate earth building technology for much of the developing world, as they make use of materials which are widely available locally and are thus relatively inexpensive.

The local context must be considered as, for example, mudbrick may not be durable in a high rainfall area (although a large roof overhang and cement stabilisation can be used to correct for this), and, if the materials are not readily available, the method may be inappropriate. Other forms of natural building may be considered appropriate technology, though in many cases the emphasis is on sustainable architecture and self-sufficiency rather than affordability or suitability. As such, many buildings are also built to function as autonomous buildings (e.g. earthships). One example of an organisation that applies appropriate earthbuilding techniques would be Builders Without Borders. Organizations as Architecture for Humanity also consider principles of appropriate technology, aiming to serve the needs of poor and disaster-affected people.

Where building height is important - e.g. to allow sustainable levels of density and efficient transport within a city - then traditional and alternative methods such as earthen buildings are not appropriate.

3) Energy

Microgeneration is appropriate to remote and mobile applications, with low power requirements. The term soft energy technology was coined by Amory Lovins to describe "appropriate" renewable energy. "Appropriate" energy technologies are especially suitable for isolated and/or small scale energy needs. However, high capital cost must be taken into account. Electricity can be provided from:

PV solar panels (which are expensive initially, but simple), and (large) Concentrating solar power plants. PV solar panels made from low-cost photovoltaic cells or PV-cells which have first been concentrated by a luminescent solar concentrator panel are also a good option. Especially companies as Solfocus make appropriate technology CSP plants which can be made from waste plastics polluting the surroundings.

- Solar thermal collector
- Wind power (home do-it yourself turbines and larger-scale)
- Micro hydro, and pico hydro
- Human-powered handwheel generators
- Plant microbial fuel cells
- Other zero emission generation methods

Some intermediate technologies (causing still some degree of air pollution -yet no CO2-emissions-) include:

Bioalcohols as bioethanol, biomethanol and biobutanol. The first two require minor modifications to allow them to be used in conventional internal combustion (gasoline) engines. The third requires no modifications at all.

And plant oils (which can be used only in internal combustion (Diesel) engines. Biofuels are locally available in many developing countries and can be cheaper than fossil fuels.

Biogas is another potential source of energy, particularly where there is an abundant supply of waste organic matter. A generator (running on biofuels) can be run more efficiently if combined with batteries and an inverter; this adds significantly to capital cost but reduces running cost, and can potentially make this a much cheaper option than the solar, wind and micro-hydro options.

Feces(eg cow dung, human, etc) can also be used. For example DEKA's Project Slingshot stirling electricity generator works this energy source to make electricity.

Biochar is another similar energy source which can be obtained through charring of certain types of organic material (eg hazelnut shells, bamboo, chicken manure) in a pyrolysis unit. A similar energy source is terra preta nova.

Finally, urine can also be used as a basis to generate hydrogen (which is an energy carrier). Using urine, hydrogen production is 332% more energy efficient than using water.

4) Water supply and treatment

As of 2006, waterborne diseases are estimated to cause 1.8 million deaths each year while about 1.1 billion people lack proper drinking water. Water generally needs treatment before use, depending on the source and the intended use (with high standards required for drinking water). The quality of water from household connections and community water points in low-income countries is not reliably safe for direct human consumption. Water extracted directly from surface waters and open hand-dug shallow wells nearly always requires treatment. Appropriate technology options in water treatment include both community-scale and household-scale point-of-use (POU) designs.

The most reliable way to kill microbial pathogenic agents is to heat water to a rolling boil. Other techniques, such as varying forms of filtration, chemical disinfection, and exposure to ultraviolet radiation (including solar UV) have been demonstrated in an array of randomized control trials to significantly reduce levels of waterborne disease among users in low-income countries.

Over the past decade, an increasing number of field-based studies have been undertaken to determine the success of POU measures in reducing waterborne disease. The ability of POU options to reduce disease is a function of both their ability to remove microbial pathogens if properly applied and such social factors as ease of use and cultural appropriateness. Technologies may generate more (or less) health benefit than their lab-based microbial removal performance would suggest.

The current priority of the proponents of POU treatment is to reach large numbers of low-income households on a sustainable basis. Few POU measures have reached significant scale thus far, but efforts to promote and commercially distribute these products to the world's poor have only been under way for a few years.

On the other hand, small-scale water treatment is reaching increasing fractions of the population in low-income countries, particularly in South and Southeast Asia, in the form of water treatment kiosks (also known as water refill stations or packaged water producers). While quality control and quality assurance in such locations may be variable, sophisticated technology (such as multi-stage particle filtration, UV irradiation, ozonation, and membrane filtration) is applied with increasing frequency. Such microenterprises are able to vend water at extremely low prices, with increasing government regulation. Initial assessments of vended water quality are encouraging. Whether applied at the household or community level, some examples of specific treatment processes include:

Porous ceramic filtration, using either clay or diatomaceous earth, and oriented as cylinder, pot, or disk, with gravity-fed or siphon-driven delivery systems. Silver is frequently added to provide antimicrobial enhancement

Intermittently operated slow-sand filtration, also known as biosand filtration

Chlorine disinfection, employing calcium hypochlorite powder, sodium hypochlorite solution, or sodium dichloroisocyanurate (NaDCC) tablets

Chemical flocculation, using either commercially produced iron or aluminum salts or the crushed seeds of certain plants, such as Moringa oleifera

Mixed flocculation/disinfection using commercially produced powdered mixtures

Irradiation with ultraviolet light, whether using electric-powered lamps or direct solar exposure

membrane filtration, employing ultrafiltration or reverse osmosis filter elements preceded by pretreatment

Some appropriate technology water supply measures include:

Deep wells with submersible pumps in areas where the groundwater (aquifers) are located at depths >10 m.

Shallow wells with lined walls and covers.

Rainwater harvesting systems with an appropriate method of storage, especially in areas with significant dry seasons.

Fog collection, which is suitable for areas which experience fog even when there is little rain.

Air well, a structure or device designed to promote the condensation of atmospheric moisture.

Handpumps and treadle pumps are generally only an option in areas where it is located at a relatively shallow depth (e.g. 10 m). The Flexi-Pipe Pump is a notable exception to this (upto 25 meter).

Condensation bags and condensation pits can be an appropriate technology to get water, yet yields are low and are (for the amount of water obtained), labour intensive. Still, it may be a good (very cheap) solution for certain desperate communities.

The hippo water roller and Q-drum allow more water to be carried, with less effort and could thus be a good alternative for ethnic communities who do not wish to give up water gathering from remote locations, assuming low topographic relief.

The roundabout playpump, developed and used in southern Africa, harnesses the energy of children at play to pump water.