Chapter 1 : Biomass Energy: Pros and Cons

Biomass Options Sustainable and cost-effective solutions for heating, electrical power generation and cooling using Biomass steam and hot water boilers. Considering using biomass energy for heating or hot water generation?

Sidebar Menu Biomass Energy The term "biomass" refers to organic matter that has stored energy through the process of photosynthesis. Many of the biomass fuels used today come in the form of wood products, dried vegetation, crop residues, and aquatic plants. Biomass has become one of the most commonly used renewable sources of energy in the last two decades, second only to hydropower in the generation of electricity. Biomass is one of the most plentiful and well-utilised sources of renewable energy in the world. Broadly speaking, it is organic material produced by the photosynthesis of light. The chemical material organic compounds of carbons are stored and can then be used to generate energy. The most common biomass used for energy is wood from trees. Wood has been used by humans for producing energy for heating and cooking for a very long time. Biomass has been converted by partial-pyrolisis to charcoal for thousands of years. Charcoal, in turn has been used for forging metals and for light industry for millenia. Both wood and charcoal formed part of the backbone of the early Industrial Revolution much northern England, Scotland and Ireland were deforested to produce charcoal prior to the discovery of coal for energy. Wood is still used extensively for energy in both household situations, and in industry, particularly in the timber, paper and pulp and other forestry-related industries. It is used to raise steam, which, in turn, is used as a by-product to generate electricity. Considerable research and development work is currently underway to develop smaller gasifiers that would produce electricity on a small-scale. For the moment, however, biomass is used for off-grid electricity generation, but almost exclusively on a large-, industrial-scale. There are two issues that affect the evaluation of biomass as a viable solution to our energy problem: There are as many environmental and economic benefits as there are detriments to each issue, which presents a difficult challenge in evaluating the potential success of biomass as an alternative fuel. For instance, the replacement of coal by biomass could result in "a considerable reduction in net carbon dioxide emissions that contribute to the greenhouse effect. We are all aware of the problems associated with denuding forests, and widespread clear cutting can lead to groundwater contamination and irreversible erosion patterns that could literally change the structure of the world ecology. Biomass has to be considered in the search for an alternative source of energy that is abundant in a wide-scale yet non-disruptive manner, since it is capable of being implemented at all levels of society. Although tree plantations have "considerable promise" in supplying an energy source, "actual commercial use of plantation-grown fuels for power generation is limited to a few isolated experiences. There is no way that plantations could be implemented at this scale, not to mention that soil exhaustion would eventually occur. Biomass cannot replace our current dependence on coal, oil, and natural gas, but it can complement other renewables such as solar and wind energy. But "as long as worldwide prices of coal, oil and gas are relatively low, the establishment of plantations dedicated to supplying electric power or other higher forms of energy will occur only where financial subsidies or incentives exist or where other sources of energy are not available.

Chapter 2 : Biomass | Student Energy

Biomass energy has been around since long before anyone spoke of renewables or alternative energy sources. There was a time when wood was the primary fuel for heating and cooking, and it is still.

Alternative energy encompasses all those things that do not consume fossil fuel. They cause little or almost no pollution. There are many impressive options that you can take into consideration such as solar tankless water heater reviews. Here in you will learn more about alternative energy sources that you can take into consideration. Solar Energy Solar is the first energy source in the world. It was in use much earlier before humans even learn how to light a fire. Many living things are dependent on solar energy from plants, aquatic life and the animals. The solar is mostly used in generating light and heat. The solar energy coming down to the planet is affected by the orbital path of the sun and its variations within the galaxy. In addition, it is affected by activity taking place in space and on the sun. It was this energy that is believed to have been responsible for the breaking of ice during the ice age, which creates the separation of lands and sea. Solar energy is one the alternative energy source that is used most widely across the globe. While solar energy is used for producing solar energy, it is also used for drying clothes, used by plants during the process of photosynthesis and also used by human beings during winter seasons to make their body temperature warm. Learn more about these methods here. There are two kinds of solar energy the active solar energy and the passive solar energy. It also uses it to induce airflow from an area to the next. Active solar energy uses electrical technology and mechanical technology like collection panels in capturing, converting and storing of energy for future use. Solar energy does not create any pollution and is widely used by many countries. It is renewable source of power since sun will continue to produce sunlight all the years. Solar panels, which are required to harness this energy can be used for long time and require little or no maintenance. It cannot be used during night and not all the light from sun can be trapped by solar panels. Solar energy advantages are much more than its disadvantages which make it as a viable source of producing alternative energy. Wind Energy This is one of the energy sources that have been in use for a very long time and for centuries. It was used in powering sailing ships, which made it possible for explorers to sail around their trade routes in distant lands. A single windmill can power the crop irrigation, and the family energy needs, water pumping and electric lights. However, in the present time there are several windmills that are used to generate required energy mostly for industrial uses. Many of the wind turbines can capture much power all at once before feeding it to the power grid. This is commonly know as wind farms and has been in use for many years all round the world. It is only the United States that is going slow in terms of accepting this alternative energy source. Wind power is renewable source of energy and reduces our alliance on foreign countries for supply of oil and gas. It does not cause any air pollution and have created several jobs in last few decades. Advancement in technologies has brought down the cost of setting up wind power plant. Wind energy can only be used in areas which experience high winds which mean that it cannot be used as a source to extract energy anywhere on earth. They sometimes create noise disturbances and cannot be used near residential areas. These disadvantages have made the use of wind energy to particular regions only. Geothermal energy means energy drawn or harnessed from beneath the earth. It is completely clean and renewable. Geothermal energy has been in used since last several years. The earth contains a molten rock called magma. Heat is continuously produced from there. The temperature increases about 3 degrees Celsius, for every meters you go below ground. Below, 10, meters the temperature is so high, that it can be used to boil water. Water makes its way deep inside the earth and hot rock boils that water. The boiling water then produces steam which is captured by geothermal heat pumps. The steam turns the turbines which in turn activates generators. Read more about working of Geothermal energy here. Geothermal energy can be found anywhere on the earth. The areas which have high underground temperatures are the ones which are the ones which are prone to earthquakes and volcanoes. The United States produces more Geothermal electricity than any other country in the world. Most hot water geothermal reservoirs are located in the western states, Alaska, and Hawaii. Geothermal energy is totally renewable as earth will continue to produce heat as long as we are all are here. Geothermal energy produces

no pollution, reduces our alliance on fossil fuels. It also results in significant cost savings as no fuel is required to harness energy from beneath the earth. These advantages make geothermal energy as one the best alternative energy source. But, geothermal has its downsides too. It is suitable to particular region and cannot be harnessed everywhere. The earth may release some harmful gases while releasing the heat which may prove adverse from mankind. Also, the areas where this energy is harnessed are prone to earthquakes and volcanoes. Apart from that, setting up of geothermal power stations requires huge installation cost. Hydroelectric Energy Solar energy is produced by sun and wind energy is produced by moving of winds. The heat caused by sun drives the wind. The movement of winds is then captured by wind turbines. Both wind and sun cause water to evaporate. The water vapor then turns into rain or snow and flows down to sea or oceans through rivers or streams. The energy of the moving water can then be captured and called as hydroelectric power. Hydroelectric power stations capture the kinetic energy of moving water and give mechanical energy to turbines. The moving turbines then convert mechanical energy into electrical energy through generators. Dams around the world have been built for this purpose only. Hydropower is the largest producer of alternative energy in the world. There are different types of hydropower plants. The selection of hydropower plant depends on many volume and flow of water. Hydropower is renewable, constant, predictable and controllable source of energy. They emit no greenhouse gases and are environment friendly. On the negative side, they may cause adverse effect on aquatic life, reduce flow of water which may affect agriculture, require huge costs to build and may cause havoc if they get breakdown. Biomass Energy This is the process by which an alternative energy is generated through conversion of biological materials and wastes into forms that can be used as energy sources for heating, power generation and transportation. Those carbon based substances or materials converted over a long period of time to fossil fuels are not regarded as biomass. However, in their original state they are regarded as biomass. This is because of the separation of the carbon they previously contained from the carbon cycle. This makes them figure differently affecting carbon dioxide levels in air. Biomass energy has been around since ancient times when people use to burn wood or coal to heat their homes or prepare food. Wood still remains the most common source to produce biomass energy. Apart from wood, the other products that are used to create biomass energy include crops, plants, landfills, municipal and industrial waste, trees and agricultural waste. Biomass is renewable source of energy as we would be able to produce it as long as crops, plants and waste exist. It does not create any greenhouse gases and is can be easily extracted through the process of combustion. Another advantage of biomass is that it helps to reduce landfills. Biomass is comparatively ineffective as compared to fossil fuels. They release methane gases which can be harmful to the environment. Read more about the advantages and disadvantages of biomass here. Ocean Energy The earth promises many power sources. Just like the geothermal and solar energy, which have long been used in heating homes and lighting as well when harnessed. Even in the last century these forms of energy was in use. Due to massive size of oceans, this energy can be used on much wider scale than other alternative sources of energy. The waves produced by the ocean and tides that hit the sea shore has enormous potential in them. There are 3 ways i. Tidal power basically involves using kinetic energy from the incoming and outgoing tides. The difference in high tides and low tides are also important in this respect. There is a lot of energy that can be harnessed from waves for use. It is another form of hydropower. The rise and fall of ocean tides are captured by tidal energy generators which turn turbines.

Chapter 3 : Biomass for Electricity Generation | WBDG Whole Building Design Guide

The author evaluates the processes in use and the options available for biomass, and explains his preferences. He analyzes the prospects for energy and chemicals from biomass in terms of.

Biomass or Bioenergy refers to the use of organic material to produce energy. This energy production process is referred to as Bioenergy. Due to the breadth of the term, the physical composition of biomass is inconsistent, but generally includes carbon, water and organic volatiles. For the production of energy from biomass, the term feedstock is used to refer to whatever type of organic material will be used to produce a form of energy. The feedstock must then be converted to a usable energy form through one of many processes. It is the simplest method by which biomass can be used for energy. In its rudimentary form, combustion is used for space heating i. The gasification process uses heat, pressure and partial combustion to create syngas, which can then be used in place of natural gas [2] Aboriginal Ankur Corporation AAC. What is Biomass Gasification? Consists of thermal decomposition in the absence of oxygen. It is the precursor to gasification , and takes place as part of both gasification and combustion [3] Biomass Energy Centre. The products of pyrolysis include gas, liquid and a sold char, with the proportions of each depending upon the parameters of the process. Anaerobic digestion or biodigestion: The methane can then be captured to produce energy. Similarily, the solid residue can also be burned to produce energy. Yeast or bacteria are added to the biomass material, which feed on the sugars to produce ethanol an alcohol and carbon dioxide. The ethanol is distilled and dehydrated to obtain a higher concentration of alcohol to achieve the required purity for the use as automotive fuel. The solid residue from the fermentation process can be used as cattle-feed and in the case of sugar cane can be used as a fuel for boilers or for subsequent gasification. Some feedstocks are more conducive for certain biomass conversion processes than others. The determination of which feedstocks and processes will be used is determined largely by the availability of resources and the desired end form of energy. Context Prior to the industrial revolution, biomass was the primary source of energy. Biomass now makes up only a small percentage of total world energy use. However, for approximately 2. The use of biomass is highly contextual to the region in which it is used â€” availability of resources, availability of technology and economic viability are all drivers of biomass use. Some jurisdictions - especially those with sustainable forestry initiatives - have declared biomass a "carbon neutral" energy source. This is based upon the logic that carbon emissions from burning biomass will be recaptured by the plants grown to feed biomass reactors in the future, thus forming a carbon cycle for the plant [5] Vieira da Rosa, A. Fundamentals of Renewable Energy Processes 3rd ed. Vieira da Rosa, A. The environmental benefits and costs are highly contextual depending on the technology and feedstocks used. The lack of appropriate ventilation mechanisms for burning biomass is a major health concern and contributes to short life expectancies in much of the developing world. Concerns associated with biomass go beyond human health. Depending upon the source of biomass used, deforestation, cropland degradation due to diverting agricultural residues , and land use alteration can all be relevant issues associated with biomass. References Biomass Energy Centre.

Chapter 4 : Biomass Energy and its Promise | EcoMENA

Biomass most often refers to As an energy source, biomass can either be used directly via combustion to produce heat, or indirectly after converting it to various forms of biofuel. Conversion of biomass to biofuel can be achieved by different methods which are broadly classified into: thermal, chemical, and biochemical.

Biomass comes from a variety of sources including wood from natural forests, agricultural residues, agro-industrial wastes, animal manure, organic industrial wastes, municipal solid wastes, sewage sludge etc. When biomass is left lying around on the ground it breaks down over a long period of time, releasing carbon dioxide and its store of energy slowly. By burning biomass its store of energy is released quickly and often in a useful way. Besides recovery of energy, these technologies can lead to a substantial reduction in the overall waste quantities requiring final disposal. As far as thermal technologies are concerned, biomass can be converted into energy by simple combustion, by co-firing with other fuels or through some intermediate process such as gasification and pyrolysis. The energy produced can be high calorific value gases, electrical power, heat or both combined heat and power. Biochemical processes, like anaerobic digestion, can also produce clean energy in the form of biogas which can be converted to power and heat. In addition, biomass can also yield liquid fuels, such as bioethanol or biodiesel, which can be used to replace petroleum-based fuels. Algal biomass is also emerging as a good source of energy because it can serve as natural source of oil, which conventional refineries can transform into jet fuel or diesel fuel. Applicability Biomass energy technology is quite flexible and can be applied at a small, localized scale primarily for heat, or it can be used in much larger base-load power generation capacity whilst also producing heat. Biomass generation can thus be tailored to rural or urban environments, and utilized in domestic, commercial or industrial applications. Biomass conversion reduces greenhouse gas emissions in two ways. Heat and electrical energy is generated which reduces the dependence on power plants based on fossil fuels. GHG emissions are significantly reduced by preventing methane emissions from landfills. Moreover, biomass energy plants are highly efficient in harnessing the untapped sources of energy from biomass wastes. Major Benefits Biomass energy systems offer significant possibilities for reducing greenhouse gas emissions due to their immense potential to replace fossil fuels in energy production. Biomass reduces emissions and enhances carbon sequestration since short-rotation crops or forests established on abandoned agricultural land accumulate carbon in the soil. Biomass energy usually provides an irreversible mitigation effect by reducing carbon dioxide at source, but it may emit more carbon per unit of energy than fossil fuels unless biomass fuels are produced unsustainably. Biomass can play a major role in reducing the reliance on fossil fuels. In addition, the increased utilization of biomass-based fuels will be instrumental in safeguarding the environment, generation of new job opportunities, sustainable development and health improvements in rural areas. Biomass energy could also aid in modernizing the agricultural economy. When compared with wind and solar energy, biomass plants are able to provide crucial, reliable baseload generation. Biomass plants provide fuel diversity, which protects communities from volatile fossil fuels. Since biomass energy uses domestically-produced fuels, biomass power greatly reduces our dependence on foreign energy sources and increases national energy security. Global Trends Biomass energy has rapidly become a vital part of the global renewable energy mix and account for an ever-growing share of electric capacity added worldwide. Traditional biomass, primarily for cooking and heating, represents about 13 percent and is growing slowly or even declining in some regions as biomass is used more efficiently or replaced by more modern energy forms. Some of the recent predictions suggest that biomass energy is likely to make up one third of the total world energy mix by

Chapter 5 : Non-nuclear options for constant energy | Letters | Environment | The Guardian

As a full-service energy services company, Con Edison Solutions' expertise extends beyond traditional renewable energy options. Experience with biomass energy is another example of our ability to look beyond the conventional solution to meet the needs of our clients.

Share via Email Wind turbines generate electricty in the shadow of Drax, now converted to biomassas a feed source. She says that no liabilities would fall to the UK taxpayer or consumer should Hinkley Point C be cancelled. Who, pray, would foot the bill to complete the project should EDF withdraw after a few years of construction when cost and time overruns became apparent, as they have with other projects in France and Finland? And assuming the plant ever began generating its costly electricity, who would be responsible for the waste management costs, the size of which can only be estimated since the location, depth, technical details about cladding, inventory, or even if there will ever be a repository, remain stubbornly vague and could yet result in indefinite storage on site? Spent nuclear fuel from Hinkley C or Sizewell C would be on their respective sites for an estimated years. Who will take title to hundreds of tonnes of spent nuclear fuel if, as is likely, within that time period, EDF disappears? As usual, the public purse would be required to bail out a private venture. Better to cancel Hinkley, Sizewell and all the other nuclear plans now while some semblance of energy policy credibility remains, than to see it unravel in the most embarrassing way over the coming decades, leaving communities like ours to carry the can for government obsession with a nuclear fix. She and her advisers will know that woody biomass also provides secure, low-carbon electricity generation. Our port-located projects at Immingham and Hull will be combined heat and power CHP plants, also offering low-cost heat to local industrial customers on Humberside, including glasshouse vegetable growers. All we now need to start building them is some government financial support, already enjoyed by other renewable power projects such as offshore wind, solar and at Drax. She should speak with her German colleagues who are satisfied that they will meet their target of becoming independent of all fossil fuels by , covering base-load with bio-digestion. This source of both gas and electricity â€” provided it is located close to a ready source of either waste vegetable matter of animal waste â€” is a win-win, as it puts to beneficial use what would otherwise release methane into the atmosphere and provides farmers with nutrient-rich irrigation ponds. Bio-digestion generation has a further advantage in that its output can be moderated to reflect demand at no cost, whereas nuclear is totally inflexible in this regard. The Finnish nuclear power station, on the same design as that planned for Hinkley Point, had, according to the Financial Times in December , descended into farce, the construction of unit three being expected to open nine years late and several billions of euros over budget. The one in France is six years late and costs have more than trebled. That we should be asking the Chinese to build Hinkley Point is beyond terrifying given their blatant disregard for human life and safety. Biomass is stored energy that can be used for electricity, heat and fuels continuously or when needed, eg by immediate combustion, as biogas, as landfill gas, via pyrolysis, via fermentation and as oils and esters. Hydro power may be both continuous and rapidly adjusted. Variable generation from wind, sunshine and tides integrates over distance and time to be, in effect over the UK, continuous, but not constant. Constancy and controlled variation are provided by storage, eg pumped hydro, pumped tidal reservoir, batteries of which there are many options , and, in effect, by demand-side load switching. Rudd goes on to praise nuclear power for aiming to supply electricity to 6m homes from a single power station. Such centralisation of multi-gigawatt capacity is not a sensible strategy because of the widespread disruption caused by unexpected generation and transmission outages, and by closures needed for refuelling. Nor sensible if we are concerned about terrorist disruption. The sensible alternative is a distributed generation system which integrates and controls power. Renewables fit a strategy for robust distributed power using a network a grid of connections, in a similar robust manner to the internet. Modern communications and control allow such a strategy, especially when blended with methods of using electricity efficiently. King Canute, some years ago, knew of the inevitability of the tide. He used it to demonstrate the ignorance of his ministers.

Chapter 6 : Alternative Energy Sources - Solar, Wind, Geothermal, Biomass, Ocean and other energy sour

Campus Biomass Energy Options A research campus could use biomass in several ways: Cofiring with coal: Biomass can often be substituted for as much as 50% of the fuel for a coal-fired boiler with minimum modifications.

Direct combustion systems feed a biomass feedstock into a combustor or furnace, where the biomass is burned with excess air to heat water in a boiler to create steam. Instead of direct combustion, some developing technologies gasify the biomass to produce a combustible gas, and others produce pyrolysis oils that can be used to replace liquid fuels. Boiler fuel can include wood chips, pellets, sawdust, or bio-oil. Steam from the boiler is then expanded through a steam turbine, which spins to run a generator and produce electricity. In general, all biomass systems require fuel storage space and some type of fuel handling equipment and controls. A system using wood chips, sawdust, or pellets typically use a bunker or silo for short-term storage and an outside fuel yard for larger storage. An automated control system conveys the fuel from the outside storage area using some combination of cranes, stackers, reclaimers, front-end loaders, belts, augers, and pneumatic transport. A less labor-intensive option is to use automated stackers to build the piles and reclaimers to move chips from the piles to the chip bunker or silo. Wood chip-fired electric power systems typically use one dry ton per megawatt-hour of electricity production. This approximation is typical of wet wood systems and is useful for a first approximation of fuel use and storage requirements but the actual value will vary with system efficiency. This water will reduce the recoverable energy content of the material, and reduce the efficiency of the boiler, as the water must be evaporated in the first stages of combustion. The biggest problems with biomass-fired plants are in handling and pre-processing the fuel. This is the case with both small grate-fired plants and large suspension-fired plants. Drying the biomass before combusting or gasifying it improves the overall process efficiency, but may not be economically viable in many cases. Exhaust systems are used to vent combustion by-products to the environment. Emission controls might include a cyclone or multi-cyclone, a baghouse, or an electrostatic precipitator. The primary function of all of the equipment listed is particulate matter control, and is listed in order of increasing capital cost and effectiveness. Cyclones and multi-cyclones can be used as pre-collectors to remove larger particles upstream of a baghouse fabric filter or electrostatic precipitator. In addition, emission controls for unburned hydrocarbons, oxides of nitrogen, and sulfur might be required, depending on fuel properties and local, state, and Federal regulations. How Does it Work? In a direct combustion system, biomass is burned in a combustor or furnace to generate hot gas, which is fed into a boiler to generate steam, which is expanded through a steam turbine or steam engine to produce mechanical or electrical energy. In a direct combustion system, processed biomass is the boiler fuel that produces steam to operate a steam turbine and generator to make electricity. Types and Costs of Technology There are numerous companies, primarily in Europe, that sell small-scale engines and combined heat and power systems that can run on biogas, natural gas, or propane. Some of these systems are available in the United States, with outputs from about 2 kilowatts kW , and approximately 20, British thermal units Btu per hour of heat, to several megawatts MW. In the United States, direct combustion is the most common method of producing heat from biomass. The two principal types of chip-fired direct combustion systems are stationary- and traveling-grate combustors, otherwise known as fixed-bed stokers and atmospheric fluidized-bed combustors. Fixed-bed systems There are various configurations of fixed-bed systems, but the common characteristic is that fuel is delivered in some manner onto a grate where it reacts with oxygen in the air. This is an exothermic reaction that produces very hot gases and generates steam in the heat exchanger section of the boiler. Fluidized-bed systems In either a circulating fluidized-bed or bubbling fluidized-bed system, the biomass is burned in a hot bed of suspended, incombustible particles, such as sand. Compared to grate combustors, fluidized-bed systems generally produce more complete carbon conversion, resulting in reduced emissions and improved system efficiency. In addition, fluidized-bed boilers can use a wider range of feedstocks. Furthermore, fluidized-bed systems have a higher parasitic electric load than fixed-bed systems due to increased fan power requirements. Biomass gasification systems Small, modular biopower system by Community Power Corporation Although less common, biomass gasification systems are

similar to combustion systems, except that the quantity of air is limited, and thus produce a clean fuel gas with a usable heating value in contrast to combustion, in which the off gas does not have a usable heating value. Clean fuel gas provides the ability to power many different kinds of gas-based prime movers, such as internal combustion engines, Stirling engines, thermo electric generators, solid oxide fuel cells, and micro-turbines. The efficiency of a direct combustion or biomass gasification system is influenced by a number of factors, including biomass moisture content, combustion air distribution and amounts excess air , operating temperature and pressure, and flue gas exhaust temperature. Application The type of system best suited to a particular application depends on many factors, including availability and cost of each type of biomass e. Projects that can make use of both electricity production and thermal energy from biomass energy systems are often the most cost effective. If a location has predictable access to year-round, affordable biomass resources, then some combination of biomass heat and electricity production may be a good option. Transportation of fuel accounts for a significant amount of its cost, so resources should ideally be available from local sources. In addition, a facility will typically need to store biomass feedstocks on-site, so site access and storage are factors to consider. As with any on-site electricity technology, the electricity generating system will need to be interconnected to the utility grid. The rules for interconnection may be different if the system is a combined heat and power system instead of only for electricity production. The ability to take advantage of net metering may also be crucial to system economics. Economics The major capital cost items for a biomass power system include the fuel storage and fuel handling equipment, the combustor, boiler, prime mover e. System cost intensity tends to decrease as the system size increases. Large systems require significant amounts of material, which leads to increasing haul distances and material costs. Therefore, determining the optimal system size for a particular application is an iterative process. A variety of incentives exist for biomass power, but vary with Federal and state legislation policies. The timing of incentive programs often allows less construction time than needed for biomass projects. Also, Federal agencies often cannot take direct advantage of financial incentives for renewable energy unless they use a different ownership structure. Of interest, the State of Massachusetts recently removed biomass-fired electricity from its Renewable Portfolio Standard, because state officials did not believe that biomass provided a clear reduction in greenhouse gases. As such, biomass projects no longer qualify for renewable energy certificates that count toward Massachusetts renewable energy goals or funding. Assessing Resource Availability The most important factors in planning for a biomass energy system are resource assessment, planning, and procurement. As part of the screening and feasibility analysis processes, it is critical to identify potential sources of biomass and to estimate the fuel quantities needed. If possible, determine, in detail, the capability of potential suppliers to produce and deliver a fuel that meets the requirements of the biomass equipment. This can be a bit of an intensive process as it involves determining the load to be served, identifying possible equipment manufacturers or vendors, working with those vendors to determine a fuel specification, and contacting suppliers to see if they can meet the specificationâ€”and at what price. It is also necessary to estimate the monthly and annual fuel requirement, as well as peak fuel use, to help with fuel handling and fuel storage equipment sizing. Since there is no established wood chip distribution system in most of the United States, it is sometimes difficult to find suppliers. One suggestion is to contact the regional U. Forest Service and state forest service offices. Other resources to contact include landscape companies, lumber mills, and other wood processors, landfills, arborists, and wood furniture manufacturers. County-level biomass resource estimates are also available online through an interactive mapping and analysis tool. Previously, resource assessment efforts were usually static and did not allow user analysis or manipulation of the data. This new tool enables users to select a location on the map, quantify the biomass resources available within a user-defined radius, and estimate the total thermal energy or power that could be generated by recovering a portion of that biomass. The tool acts as a preliminary source of biomass feedstock information; however, it cannot take the place of an on-the-ground feedstock assessment. Available biomass resources in the United States. NREL A process must be developed to receive biomass deliveries and to assess the fuel properties. As of July , there are no national wood chip specifications, but regional specifications are being developed. Having a specification helps to communicate and enforce chip requirements. The specification should include physical dimensions, fuel moisture content

range, energy content, ash and mineral content, and other factors that affect fuel handling or combustion. To ensure fair value, fuel procurement contracts should scale purchase price inversely with moisture content, as higher moisture content significantly decreases combustion efficiency and increases the weight of material to be transported. Procurement Considerations The following recommendations are critical to the success of any biomass energy project. Fully involve decision-makers and the general public during the planning stages and as progress is made, particularly if the system will be installed in a public building. Work closely with a biomass equipment manufacturer or vendor to collaborate on building design and equipment requirements. Coordinate building scheduling with the equipment delivery. For example, it is easier to deliver and install the equipment if a crane can access the installation site. Identify a fuel delivery route, to ensure that trucks can reach the storage area easily and turn around, if necessary. In other respects, these systems are similar to other boiler-based electricity production systems. Operation is continual, so costs for operation and for the purchase and storage of fuel need to be assessed with the overall project costs. Special Considerations The following are important special considerations for biomass electric systems. Therefore, local requirements should be reviewed. Air emissions from a biomass system depend on the system design and fuel characteristics. If necessary, emissions controls systems can be used to reduce particulate matter and oxides of nitrogen emissions. Sulfur emissions are completely dependent on the sulfur content of the biomass, which is usually very low. The storage of wood chips requires consideration, preparation, and attentiveness. When the chips are stored in a building, there is potential for dust from the chips to build up on horizontal surfaces and to get inside equipment. Preventing and Mitigating the Effects of Fire and Explosions. This is due to a chain of events, which starts with the biological breakdown of the organic matter and can lead to smoldering of the pile. The probability of spontaneous combustion also increases as pile size increases, due to the increasing depth. To help with this issue, the Office of the Fire Marshal fire code in Ontario, Canada provides the following guidelines: The storage site shall be well-drained and level, solid ground or paved with asphalt, concrete, or other hard surface material. The ground surface between piles shall be kept free of combustible materials. Weeds, grass, and similar vegetation shall be removed from the yard. Portable open-flame weed burners shall not be used in chip storage yards. Piles shall not exceed 18 m 59 ft in height, 90 m ft in width, and m ft in length unless temporary water pipes with hose connections are laid on the top surface of the pile. Space shall be maintained between chip piles and exposing structures, yard equipment, or stock equal to a twice the pile height for combustible stock or buildings, or b the pile height for non-combustible buildings and equipment. Smoking shall be prohibited in chip pile areas. Wood chip fires can be caused by other factors, such as lightning strikes, heat from equipment, sparks from welding activities, wildfires, and arson. These fires are sometimes called surface fires because they start, and spread, along the exterior of the pile.

Chapter 7 : How Biomass Energy Works | Union of Concerned Scientists

National Renewable Energy Laboratory Biomass Resources and Technology Options. Tribal Energy Program Project Review Meeting Golden, CO November 20,

This section needs additional citations for verification. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed. November Thermal conversions[edit] Trends in the top five countries generating electricity from biomass Thermal conversion processes use heat as the dominant mechanism to convert biomass into another chemical form. Also known as thermal oil heating, it is a type of indirect heating in which a liquid phase heat transfer medium is heated and circulated to one or more heat energy users within a closed loop system. These processes reduce carbon emissions during processing of biomass while providing useful byproducts which can later be used in several applications. There are other less common, more experimental or proprietary thermal processes that may offer benefits, such as hydrothermal upgrading. Some of the applications of thermal conversion are combined heat and power and co-firing. Many of these processes are based in large part on similar coal-based processes, such as Fischer-Tropsch synthesis , methanol production, olefins ethylene and propylene , and similar chemical or fuel feedstocks. In most cases, the first step involves gasification, which step generally is the most expensive and involves the greatest technical risk. Therefore, biomass gasification is frequently done at atmospheric pressure and causes combustion of biomass to produce a combustible gas consisting of carbon monoxide , hydrogen , and traces of methane. This gas mixture, called a producer gas , can provide fuel for various vital processes, such as internal combustion engines , as well as substitute for furnace oil in direct heat applications. In addition, biomass gasification is a desirable process due to the ease at which it can convert solid waste such as wastes available on a farm into producer gas, which is a very usable fuel. These chemical are then further reacted to produce hydrogen or hydrocarbon fuels. Halomethanes have successfully been by produced using a combination of A. S-adenosylmethionine which is naturally occurring in S. This method may be applied to produce ethylene in the future. Other chemical processes such as converting straight and waste vegetable oils into biodiesel is transesterification. Biochemical conversion makes use of the enzymes of bacteria and other microorganisms to break down biomass into gaseous or liquid fuels, such a biogas or bioethanol. Glycoside hydrolases are the enzymes involved in the degradation of the major fraction of biomass, such as polysaccharides present in starch and lignocellulose. Thermostable variants are gaining increasing roles as catalysts in biorefining applications in the future bioeconomy, since recalcitrant biomass often needs thermal treatment for more efficient degradation. This can be performed directly in a direct carbon fuel cell , [49] direct liquid fuel cells such as direct ethanol fuel cell , a direct methanol fuel cell , a direct formic acid fuel cell , a L-ascorbic Acid Fuel Cell vitamin C fuel cell , [50] and a microbial fuel cell. The MW facility uses sugarcane fiber bagasse and recycled urban wood as fuel to generate enough power for its large milling and refining operations as well as to supply electricity for nearly 60, homes. These tend to use feedstock produced by rapidly reproducing enzymes or bacteria from various sources including excrement [59] grown in cell cultures or hydroponics. Rail and especially shipping on waterways can reduce transport costs significantly, which has led to a global biomass market. Such small power plants can be found in Europe. When the biomass is from forests, the time to recapture the carbon stored is generally longer, and the carbon storage capacity of the forest may be reduced overall if destructive forestry techniques are employed. Some of these challenges, unique to biomass plants, include inconsistent fuel supplies and age. The type and amount of the fuel supply are completely reliant factors; the fuel can be in the form of building debris or agricultural waste such as removal of invasive species or orchard trimmings. In fact, many are based on technologies developed during the term of U. Energy Information Administration projected that by , biomass is expected to be about twice as expensive as natural gas, slightly more expensive than nuclear power, and much less expensive than solar panels. This data also includes minor infractions. Typically, perennial crops sequester much more carbon than annual crops due to much greater non-harvested living biomass, both living and dead, built up over years, and much less soil disruption in cultivation. The proposal that biomass is carbon-neutral put forward in the early s

has been superseded by more recent science that recognizes that mature, intact forests sequester carbon more effectively than cut-over areas. Current studies indicate that "even after 50 years the forest has not recovered to its initial carbon storage" and "the optimal strategy is likely to be protection of the standing forest". There is controversy surrounding the usage of the ILUC factor. Greenpeace recently released a report entitled "Fuelling a BioMess" [89] which outlines their concerns around forest-based biomass. Because any part of the tree can be burned, the harvesting of trees for energy production encourages whole-tree harvesting , which removes more nutrients and soil cover than regular harvesting, and can be harmful to the long-term health of the forest. In some jurisdictions, forest biomass removal is increasingly involving elements essential to functioning forest ecosystems, including standing trees, naturally disturbed forests and remains of traditional logging operations that were previously left in the forest. Environmental groups also cite recent scientific research which has found that it can take many decades for the carbon released by burning biomass to be recaptured by regrowing trees, and even longer in low productivity areas; furthermore, logging operations may disturb forest soils and cause them to release stored carbon. There are several potential challenges unique to bioenergy supply chains:

Chapter 8 : Biomass - Wikipedia

biomass energy The methods used to produce energy with biomass vary depending on the type of biomass and its intended use. In QuÃ©bec, the combustion of solid biomass.

Click to print Opens in new window Biomass energy has been around since long before anyone spoke of renewables or alternative energy sources. There was a time when wood was the primary fuel for heating and cooking around the world. It is still used that way today, though in many fewer locations in countries like ours. When we speak of biomass today, we are basically talking about several different applications: Direct burning for domestic heat: This is the traditional method of burning wood, peat, dung, etc. It is still widely used, especially in developing countries where it is responsible for many respiratory illnesses and deaths. Biomass is used to feed a boiler which then provides steam to a turbine which is connected to a generator. EIA predicts that by , biomass will produce 0. Essentially the same as item 2 above, with the addition that useful heat is withdrawn from the process, improving its efficiency in a combined heat and power CHP arrangement. The biomass is heated in an environment where it breaks down into a flammable gas. After the gas is cleaned and filtered, it can then be used as natural gas, usually in a combined cycle turbine. Feedstocks used primarily include forest and agricultural residues. Enzymatic digestion and other catalysts are used to enhance conversion. Suitable fuels are organic materials with high moisture content such as animal manure or food processing waste. Landfill gas which is siphoned off of active landfills can also be considered part of this category, though, in this case, there are concerns about toxins released, though some technologies claim to eliminate many of them. This category includes any kind of biomass that is converted into liquid fuel, primarily for transportation. Most common are ethanol and biodiesel. Ethanol can be produced from food crops such as corn in this country, sugar cane in Brazil and sugar beets in Europe. Biodiesel is generally made from animal fats or vegetable oils. Commercially, soybean oil is used in the US, rapeseed and sunflower oil in Europe, and palm oil in Malaysia. Algae-based biofuel is a special case, which we covered in a separate posting. While convenient for transportation, biofuels require considerably more energy to produce than biomass. Biomass is often advertised as carbon neutral or nearly carbon neutral, but this can be misleading. It is true that the carbon released upon burning it was only recently in relative terms pulled out of the atmosphere, so it can be viewed as returning what was already there before the plant came up. But any additional carbon emitted in cultivating, harvesting and transporting the fuel, which can be considerable, is incremental to that. The less carbon emitted in these stages of production, the closer the resulting fuel is to carbon neutrality. There is also the question of fertilizers, pesticides and herbicides, if used, and the energy and resources used and carbon emitted in producing them. Biomass Energy Pros and Cons: Pros Widely available and naturally distributed Generally low cost inputs Can be domestically produced for energy independence Low carbon, cleaner than fossil fuels Can convert waste into energy, helping to deal with waste Cons Energy intensive to produce. In some cases, with little or no net gain. Land utilization can be considerable. Can lead to deforestation. Overall process can be expensive Some methane and CO2 are emitted during production Not easily scalable While biomass seems compelling at first blush, given that it is renewable and can be domestically produced, there are a number of drawbacks that make it far from a perfect solution. Primarily, as our population continues to grow, the competition for arable land and water needed for food production is going to make a number of these options unsuitable. The most attractive and efficient options are those that utilize existing waste materials as inputs, which is, after all, the way nature operates. There are a number of these options that utilize forestry, agricultural, and even industrial waste e. Not only are these more efficient input sources, but in many cases using them will also help to address waste disposal issue. It could be argued, though, that in the future, many of these same materials might be needed for compost, particularly as the production of phosphorus, a key ingredient in fertilizer, begins to decline.

Chapter 9 : Biomass Energy, definition of biomass energy and the types of biomass energy, pros and cons

DOWNLOAD PDF ENERGY, THE BIOMASS OPTIONS

For the production of energy from biomass, the term feedstock is used to refer to whatever type of organic material will be used to produce a form of blog.quintoapp.com feedstock must then be converted to a usable energy form through one of many processes.