Community Energy Planning 18 March 2007; R. E. Clark III

Below are some notes and references to contribute toward the discussions related to long term planning for energy requirements (some 10 to 40 years into the future) for the Upper Gunnison River Basin Community. The sources of information given below may be helpful. Because website addresses tend to change, search on topics or on the names of entities.

Recent discussion of the proposed extension of 10 years to the present 30 plus years of Gunnison County Electric Association's contract with the Tri-State Generation and Transmission Association for electrical power has stimulated a very useful flow of thoughts. However, little attention has been given to potential responses by energy users within the Upper Gunnison River Basin Community to technological changes over this period of time. These can result in greater energy conservation, local energy generation, efficient local transmission capabilities, and explicit planning to reduce dependencies upon sources of energy from far outside the community. Technological development is occurring so rapidly that within 40 years, most dwellings and other parts of the built environment will be able to provide most, if not all, of their normal energy requirements on-site and perhaps also contribute extra energy to local needs. This also creates greater local security and comfort in the event that energy supplies from outside the community are interrupted or permanently stopped. Over time, creation of less demand for energy from sources beyond the community area can result in higher prices per unit for what is received and then result in yet further declines in demand.

Below are concepts and examples showing the need for greater consideration of how the Upper Gunnison River Basin Community might plan for serving its long term energy requirements.

1. Conservation Reduce energy requirements

How - Housing designed with orientation for passive solar design, south-facing glazing of up to 7% or more of the building area, thermal mass, window insulation panels, design for summer shading and natural cooling, vegetated roofs, and other features can greatly reduce or eliminate the need for reliance on energy from off-site for heating and cooling.

Source: U. S. Department of Energy, National Renewable Energy Laboratory, web site.

Source: U. S. Department of Defence (2004) Unified Facilities Criteria (UFC) - Low Impact Development, web s.

How - Individual building designs and equipment utilizing improved solar systems for heating air and water, electrical power generation, and operating cooling systems are more efficient and less costly for both dwelling units and commercial or office applications.

Source: City of Stockton, California, Energy Efficiency web site.

How - Emphasize upon pedestrianism, mixed-use, and long term maintenance considerations in design of new community development can reduce energy requirements for transport.

Source: Nelessen A. C. (1994) Visions For A New American Dream - Process, Principals, and An Ordinance To Plan And Design Small Communities, Planners Press, American Planning Association, Chicago, Illinois, 374 pages.

Source: Wilson A., Uncapher J. L., McManigal L., and others (1998) Green Development; Integrating Ecology And Real Estate, Rocky Mountain Institute, John Wiley and Sons Inc., New York, New York, 522 pages.

2. Energy Production By Individual Units

Individual dwelling, commercial, office, and industrial units can produce much or all of their energy requirements, particularly for electrical power, heating, and cooling. This can result in cost savings but is also sought to provide greater reliability, security, and sometimes savings in transmission.

How - In 2000, the Delta - Montrose Electric Association, a member of the Tri-County Association, offered a 10kw stationary fuel cell generator for an initial price of $8,200 and anticipated that the cost of such home systems would drop $3,000 to $4,000 per system within five to seven years. The units were made by were made by H-Power and about 5 feet by 4 feet by 3 feet in size. The cells were used proton exchange membranes or polymer electrolyte membranes and could be fueled by sources of hydrogen such as propane, natural gas, methanol, and ethanol. These in-house generation units also reduced costs to construct and maintain electric transmission lines to serve low density housing development.

Source: GCEA News, Colorado Country Life Magazine, December 2000, page 9.

Source: Torrero E. and McClelland R. (2002) Residential Fuel Cell Demonstration Handbook, NREL/SR-560-32455, prepared for the National Rural Electric Cooperative Association Cooperative Research Network, National Renewable Energy Laboratory,

Golden, Colorado, multiple sections with about 90 pages, web site.

How - The Ballard Corporation announced a new cogeneration system for use in Japan. It is designed to provide the first 1 kwh of electrical production for a home, to operate over 10 years, to be fueled by natural gas or kerosene, and to provide for all household hot water requirements. The intent is to reduce dependance on the grid for base electrical power in the event of grid system failures. At the national average cost of US$0.21 per kilowatt hour in Japan, customers will save $600 in annual energy costs and carbon dioxide emissions are reduced 40%.

Source: CCN Matthews (2006) Ballard Delivers First Prototypes Of Third Generation Long-Life Fuel Cell For Residential Cogeneration, June 8, LexisNexis, 3 pages, web site.

How - A fuel cell electric generator designed for underdeveloped villages in the third-world can produce about 1,000 watts of electrical power, 1,000 watts of heat, and 10 gallons of purified drinkable water an hour. The designer is Dean Kamen who designed the Segway super-scooter. The cost is around $1,000 per unit.

Source: Grossman L. (2003) Water Purifier, Time, November 17, at front of special section on new technologies.

How - Parabolic trough solar collectors can be used to provide hot water for individual houses or larger facilities. The Federal Correctional Institution near Phoenix, Arizons, has 18,000 square feet of these collectors providing for the hot water needs of 1,100 inmates and staff. The heat can be stored for extended periods. Such a collector system can also provide steam for generating electricity at a commercial or office complex.

Source: Industrial Solar Technology Corp (1999) website.

Source: Abboud L. (2006) Why Sun Reigns on Spain's Plains, The Wall Street Journal, 5 December, p. A4.

How - The commissioners of Pitkin County, Colorado, are spending $10,000 on a study to determine the feasibility of utilizing methane from the county land fill to generate electrical power. This is done in many other communities. Excess power generated over the needs of the landfill would be feed into the grid for a credit.

Source: Anon. (2007) Landfill's gas may be powerhouse, The Denver Post, 19 January, page 5B.

How - Nexterra Energy Corp. and Johnson Controls Inc. have designed and built a 72 MMBtu/hr biomass gasification system for the University of South Carolina. The system will provide 60,000 lbs/hr of steam for campus heating and cooling use and 1.38 MW of electricity that will be sold to the grid. The cost is US $16 million. The system uses residue from local sawmills, helps the university become more energy self-sufficient, and reduces its energy costs.

Source: CNW Group (2007) Nexterra Biomass Gasification System Nears Completion, 31 January, 3 pages, web s

3. Energy Production By Community Units

Utilization of resources from within or produced by a community to locally serve energy requirements.

How - A cow can generate about 2000 Kwhs of electricity with its manure each year. Processing manure from about 4.5 cows for methane production would be required to supply the average residential meter in the GCEAcommunity. Gunnison County was reported to have about 22,000 beef cows and calves as of 1 January 2006.

Source: McNeil Technologies Inc. (2005) Handbook on Renewable Energy Financing for Rural Colorado, prepared for the Colorado Governor's Office Of Energy Management and Conservation, Denver, Colorado, 57 pages, web s.

Source: Colorado / USDA Livestock Inventory web site.

How - A grassroots group in Highlands Ranch is planning for a portion of the large development to become a city completely free of dependence on fossil fuels. The proposed incorporated city will become a "City of The Future" with successful "clean technology incubator" developments providing sufficient royalties and fees to replace sales taxes.

Source: Thornton S. (2007) Grand Vision For A City Of The Future, The Denver Post, 1 March, 2 pages.

How - Below are sources for recent discussion of costs for alternative solar, biomass, geothermal, biofuels, and wind technologies. Most utilities have little incentive to reduce demand for their product or improve efficiencies in production.

Source: Multiple authors (2007) The New Math Of Alternative Energy, special section ofThe Wall Street Journal, 12 February, pp. R1 - R14.

Source: Anon. (2007) Technology Quarterly Report, The Economist, 10 March, 32 pages.

How - Alameda County officials showed off the one of the San Francisco Bay Area's largest fuel cell installations which is located at the Santa Rita Jail. It will serve a jail facility for 4,000 inmates which had a yearly power bill of $1.6 million. The system uses natural gas. After grants and incentives, the cost was $3.7 million financed with a 15 year loan. Generated heat will be used for facility needs. The fuel cell can use gases from landfills and waste treatment. The fuel cell provides security and back-up in the event of a cut-off of electricity as occurred in 2000 and 2001.

Source: Douglas E. (2006) Jail Opens Door To More Energy Self Sufficiency, The Los Angeles Times, 10 August, 3 pages, web site.

How - Large size fuel cell installations utilizing natural gas have been in place for several decades as backup electrical power sources for hospitals, airport, military facilities, mines, and as power generators in remote locations. Such units provide a quiet, clean, and highly efficient on-site electrical power generating system and the available thermal energy that can also reduce facility energy service costs by 20% to 40%. Conversion efficiency can be 40% to 60% and thermal recovery can be around 75% or higher of available energy. Systems are usually installations of 200kW to 250kW generating capacity. They are about 10 by 25 by 10 feet in size. Most installations are solid oxide fuel cell systems. These operate at the highest temperatures and are most tolerant of impurities found in natural gas drawn directly from the ground or from sources such as landfills. Emissions data and life-cycle cost analyses are available. The initial base cost is $650,000 to $900,000 per installation.

Source: U. S. Department of Energy (1995) Federal Technology Alert - Natural Gas Fuel Cells, 32 pages, web s.

Source: U. S. Department of Energy (2003) Types of Fuel Cells, Hydrogen, Fuel Cells, and Infrastructure Program, 8 pages, web site.

How - Various technologies are available for biomass conversion by liquification and gasification using pyrolysis, material reforming and supercritical water partial oxidation. Types of feedstock include wood, grasses, algae, feedlot manure, old hay, paper sludge, municipal sewage, household garbage, tires, construction scrap, plastics, grease, and other post consumer waste aside from those containing lots of metals. The resulting output is varying mixes of primarily hydrogen, natural gas, naphta, and chars which can be utilized locally for production of electricity and heat. Some processes can produce a fuel for transportation use. Benefits can include local energy production, emission control, reduction in landfill deposits, more efficient recycling, the local utilization of locally produced material such as wood from forestry thinning practices. Coal can also be used as a feedstock with more effective control of emissions than usually occurs at most coal-fired electrical power generation plants.

Source: U. S. Department of Energy, National Renewable Energy Laboratory - numerous conference proceedings, progress reports, and technical reports, on web sites.

Source: Gorman J. (2002) Hydrogen: The Next Generation - Cleaning Up Production Of A Future Fuel, Science, 12 October, pp. 235 - 236, web site.

How - International comparisons of detailed costs for alternative electrical power generation technologies with various types of coal-fired power plants by costs for construction, efficiencies, emissions, operational characteristics, and decommissioning.

Source: The Royal Academy of Engineering (2004) The Costs Of Generating Electricity, report by the Academy, London, England, summary is 60 pages, web site.