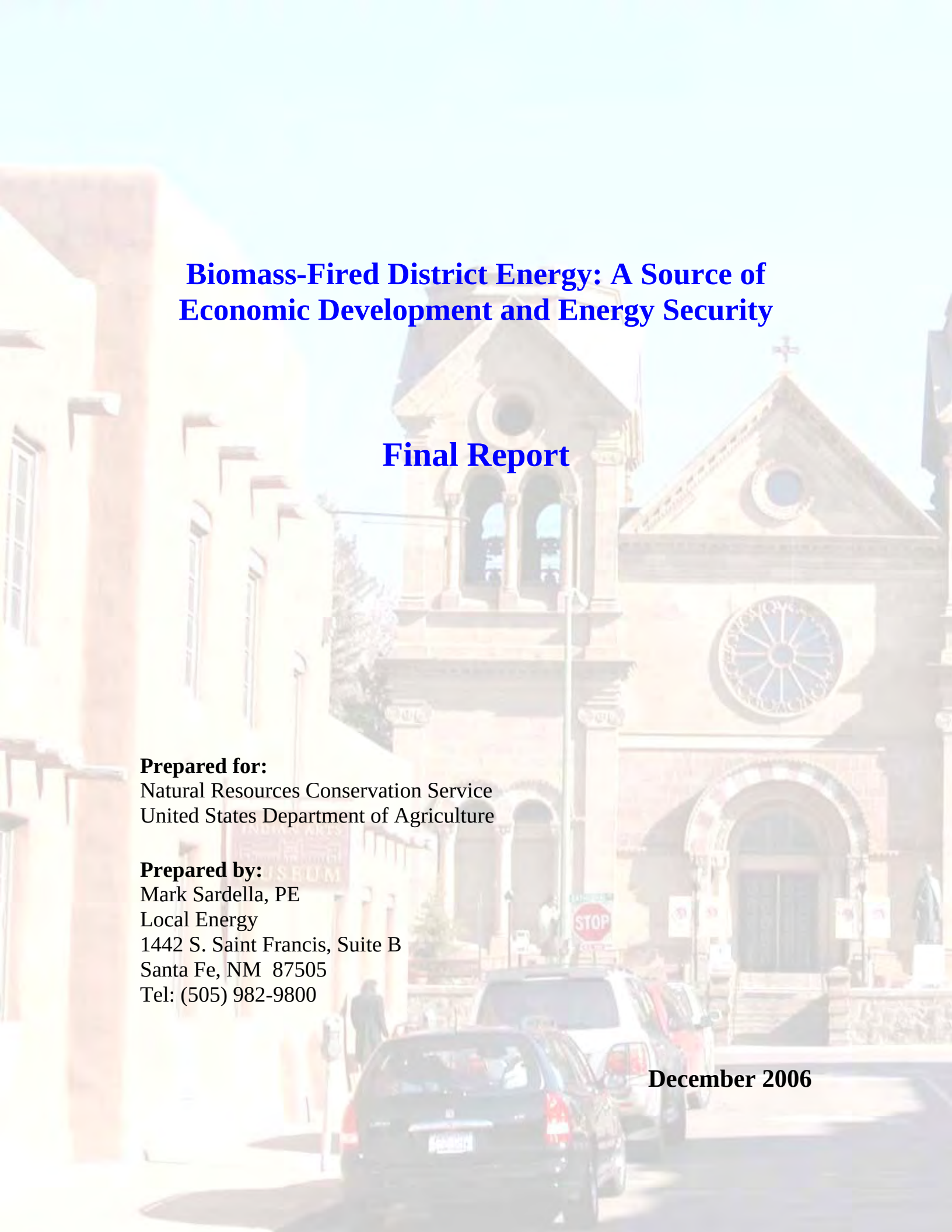

Biomass-Fired District Energy: A Source of Economic Development and Energy Security

Final Report

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Cover Photo: *Saint Francis Cathedral, as seen from the Plaza in Santa Fe, New Mexico. Photo by Klaus Supancic.*

EXECUTIVE SUMMARY

A three-year study was carried out to design an energy project for Santa Fe, New Mexico in such a way that the local economic benefits created by the system are maximized. The project is to be a biomass-fired district energy system capable of heating the core of downtown Santa Fe with locally sourced biomass. Components of the project are:

- Technical – Design of the System
- Financial – Costs, Revenues, and Payback
- Environmental – Emissions Reductions and their Value
- Fuel – Quantity, Quality, and Cost
- Economics – Income and Energy Trends, Benefits of Localization
- Education – Papers, Articles, Lectures, and Curriculum
- Social – Ownership and Governance Structure of the Project

The technical study characterized the heat load of downtown Santa Fe by performing energy audits in 106 buildings downtown, including 10 residences, 18 commercial spaces, 15 hotels, 2 churches, and 8 schools. Based on the calculated load and load-density, two sites were selected as possible sites for the heating plant: the old Waste Transfer Station and the site of the old Coal-Fired Power Plant. Network lengths were calculated at 18.5 and 13.6 miles, respectively. Heating plants of two kinds were designed for each location: heat only, and combined heat-and-power (CHP). The heating plants have approximately 44-million BTU per hour of biomass-heating capacity, and nearly twice that capacity in gas-fired capacity. Even so, biomass provides about 95 percent of the annual heat load. The CHP plants have 1.1 megawatt-capacity, and generate electricity using an organic Rankine cycle process that uses silicon oil as the working fluid. Such systems are very low maintenance and have a proven track record of more than 6 years with biomass.

The financial analysis shows costs of the four system options (two configurations at two locations) ranging from $21.6 to $27.1 million. Heat is expected to be sold from the system at the current prevailing rate for gas heat, which is about $14.07 per MMBTU. Annual revenues from heat sales at this price are about $2.2 million. There is potential for an additional $50,000 in annual revenues from the sale of emissions credits, which could rise considerably in the future. None of the four design options show a positive financial performance in the conventional sense, with a dynamic payback of less than fifteen years, unless subsidies are provided. With a $12.8 million subsidy, the “heat-only” configuration at the Waste Transfer Station has a 15-year dynamic payback. The financial performance of all systems improves dramatically if the heat price is escalated. Adjusted for inflation, the cost of gas-fired heat in Santa Fe has been escalating 6.7 percent per year on average over the last 10 years, and 21.1 percent per year over the last three years.

Emissions from the system are compared to baseline emissions using both macro and micro-analyses, and show significant reductions in carbon dioxide and hydrocarbons. Particulate emissions rise (there are no particulates in gas), but the level remains low due to high efficiency and aggressive after-treatment of the flue gases. Nitrogen emissions also rise slightly, but remain low compared to vehicle emissions.

Market Vehicles for capitalizing on the value of the roughly 13,000 tons of reduced carbon emissions are investigated. These are worth about $4 per ton in U.S. markets, and several times that if they could only be sold abroad. As an alternative, there may be more value in green-credits generated by the system, as some trial markets of thermal green-energy credits are being tested.

We looked at forest-thinning projects, municipal landfills, and commercial sawmills within a 50-mile radius of Santa Fe, and identified more than 30,000 tons of biomass fuel available on a sustainable basis. This is about 150 percent of the fuel requirement for the system. Far more supply exists, especially in planned forest-thinning projects (which were not counted—we only considered projects that had both environmental approvals and funding). About 24,000 of the 30,000 tons available were from the 10 sawmills we visited or spoke with.

Our economics study shows a significant and growing energy burden on Santa Fe County residents. Incomes over the past 12 years have grown just 5 percent faster than inflation, and the cost of home heating has risen 65 percent over the same period. The effect is regressive for a number of reasons, but primarily because low-income households already spend a disproportionate share of their income on energy, so increases in energy bills hit hard. The increased retention of energy dollars in the local community generates between $79 million and $8.9 billion in economic benefits over the 50-year life of the system, depending on how fast gas-costs rise. If the benefits are discounted to consider the real cost of money, which is arguably—but not necessarily—valid, the discounts reduce to between $27 million and $1.1 billion – still quite significant. These numbers are deemed highly conservative, as the rely on gas-price escalation rates that are significantly lower than what we have experienced locally. The model furthermore fails to consider the increased fraction of utility bill payments that leave the community when the hike in bills is due to an increase in the cost-of-gas portion of the bill, which is entirely non-local.

For our education effort, we publicly screened our documentary video five times, showing it to more than 400 people, and distributed 100 copies locally, nationally, and internationally. We developed and taught a course in biomass at the Santa Fe Community College, and gave interviews on three radio stations. We also gave more than 40 lectures and presentations about the project and the principles behind it. We are featured in the current issue of Santa Fe Trend, with a full-page photo and interview.

We studied four possible models for ownership of the system that seem most appropriate for carrying out the social and economic goals: municipal ownership, community trust, cooperative ownership, and community corporation, which has residency requirements attached to the voting stock.

The biomass system for Santa Fe is technically feasible, economically beneficial, and environmentally important. More than that, given the increasingly serious situation with natural gas, it is absolutely necessary. Sitting idly by while Santa Feans shell out more money each year, deepening their dependence on a depleting resource, would be unconscionable.