

A Waste-To-Energy Power Plant with CO₂ Sequestration

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Abstract

This paper assesses the technical and economic feasibility of a novel idea: Reducing the emission of carbon dioxide, the greenhouse gas contributing to global warming, by combusting solid wastes with industrial oxygen mixed with recirculated flue gas. The process gas, consisting mostly of carbon dioxide, would be compressed and used in Enhanced Oil Recovery (EOR) projects. By using municipal and other organic wastes that are currently landfilled as a fuel and sequestering the carbon dioxide product of combustion underground, such a process would provide the maximum environmental advantages possible, by producing electricity renewably without emitting greenhouse gases. The results of this preliminary analysis indicate that this may be a good opportunity to reduce carbon emissions at a lower cost than other methods of carbon sequestration.

Keywords: *WTE, waste-to-energy, combustion, solid wastes, oxygen enrichment, enhanced oil recovery, carbon dioxide, sequestration, greenhouse gas*

Introduction

Over the past decade, there has been growing interest in reducing greenhouse gas emissions that contribute to global warming. While the U.S. is not a member nation of the Kyoto Protocol, several greenhouse gas emissions trading initiatives are being planned or implemented at the state level and at least one is being proposed in the congress. This paper assesses the technical and economic feasibility of combusting a selected stream of solid wastes with industrial oxygen mixed with recirculated flue gas consisting mostly of carbon dioxide, thus resulting in a high-CO₂ product stream that can be captured, compressed and sold to Enhanced Oil Recovery (EOR) projects.

Enhanced Oil Recovery by Carbon Dioxide Injection

A key element of the economics of this process is the availability of a market for CO₂ utilization or disposal. Currently, several commercial processes exist that utilize and effectively dispose of pure carbon dioxide. The major market is that for enhanced oil recovery (EOR). In EOR, carbon dioxide is injected in oil wells and dissolves in the “in situ” oil, thus increasing its volume and reducing its viscosity. This increases the mobility of the oil, resulting in the recovery of oil that has been by-passed by primary and secondary recovery methods. Typical carbon dioxide “floods” can yield an additional 7 to 15 percent of the original oil in place (OOIP), thus extending the life of a producing field by as much as 15-30 years (Moritis, 2001).

The use of carbon dioxide is the fastest growing method of EOR and accounts for about 25% of all EOR projects in the US. According to a recent EOR survey (Ruether, 2002), there are 64 ongoing CO₂-EOR projects in the US, accounting for 3.3% of total US crude production. Of these, 47 are located in the Permian Basin area of West Texas and Southeast New Mexico, shown in Figure 1 (Ruether, et al 2002). Other areas include the