Re: Hydrogen as Coal replacement, NOx emissions.

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- *From*: Willie.Mookie@xxxxxxxxx
- *Date*: Thu, 20 Dec 2007 19:44:22 −0800 (PST)

On Dec 21, 6:27 am, jgra...@xxxxxx wrote:

> Willie.Moo...@xxxxxxxxx writes:
>
> > ...The success of that project triggers several power plant projects that
> > will switch from coal to hydrogen which I have recently negotiated.
> > This hydrogen is delivered from old mine sites by hydrogen gas
> > pipeline, along high tension wire rights of way, Do enough coal
> > fired power plants in a region,
>
> Does burning hydrogen (in air) in a converted coal power plant produce
> NOx emissions?

It can.

> If so, and if it were desireable to reduce the NOx,
> how could that be accomplished?

The formation of "thermal NOx" increases with increases in the
concentrations (amounts per unit
volume) of nitrogen, oxygen, and the combustion temperature. At
combustion temperatures below
2,370F, smaller concentrations of NOx are formed, and below 1400F
almost no NOx is formed.
The methods for the reduction of NOx formation are all based on
controlling the temperature
and/or by limiting one or more of the concentrations of oxygen,
nitrogen, or the fuel.

1. Less Excess Air

Air in excess of that required to completely oxidize the fuel has been
shown to correlate with
the amount of NOx formed. Limiting the net excess air flow to under 2%

limits the amount of excess oxygen available for the formation of NOx

2. Air Staging

To effect air staging, the air is divided into two streams. In the first stream, fuel is mixed with an insufficient amount of air for complete combustion. The second air stream is injected downstream from the flame and results in a slight excess of air. This technique is used to keep the temperature relatively low as well as the oxygen concentration in the primary combustion area. High efficiencies have been reported with the use of this technology.

3. Over Fire Air

This is another technique for reducing the combustion temperature by staging the main combustion zone such that the combustion temperature is lowered thereby lowering the formation of NOx. In this approach, the primary combustion is carried out with a fuel−rich mixture. The lack of oxygen needed for complete combustion holds down the combustion rate which in turn limits the combustion temperature. After the stages of combustion have been completed, the remainder of the fuel is oxidized in over fire air. In this process, some excess of air is used

4. Fuel Reburning

When cooled combustion gas and additional fuel are recirculated, some of the heat of combustion is absorbed by the cooled combustion gas thereby lowering the temperature and the NOx production. Also, when the cooled combustion gas and fuel are added as a secondary combustion stage, the oxygen in the NOx tends to oxidize the fuel producing molecular nitrogen (N2) and oxygen (O2). Burning of the remaining fuel is completed in a later stage using either combustion air nozzles or over fire air. This technique has been demonstrated to be effective with residence times from 0.2 seconds up to 1.2 seconds. Reductions of NOx up to 76% have been achieved by this technique

5. Low NOx Burners

In a low NOx burner, a stable flame is provided over several different
zones. As an
example, the first zone can be primary combustion, and the second may
be fuel reburning
in which fuel is added to chemically reduce the NOx to molecular
nitrogen (N2) and
oxygen (O2). The third zone may consist of the final combustion which
is carried out with low
excess air to limit the temperature. Many variations of the above LNB
for the reduction of
NOx exist.1,4 The LNB control technology has the largest experience
base of any technology
in the United States. Over the last decade, several generations of low
NOx burners have
evolved; see for example Babcock Borsig Power, DB Riley.7 The low NOx
burners (LNB)
have achieved up to 80%*1reduction of NOx.

> Add an oxygen pipeline in the same right−of−way,
> and burn the H2 in O2 instead of in air,
> instead of just venting the O2?

Depends on the logistics of doing this. This is possible in a
regenerative fuel cell type application for example, but would not be
feasible in other applications.

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