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## **Question 65: What methods do you use for heat recovery from furnace flue gas equipment at ~260°C (500°F)?**

**Eric Thraen (Flint Hills Resources)**

Air preheat systems are used for recovery of heat from flue gas down to app. 300 deg F. The 300 deg F temperature is set based on limiting dewpoint corrosion on cold metal surfaces. This temperature will vary depending on the materials employed, the sulfur content of the treated fuel gas, and cold ambient temperature. APH systems are not new ideas but the justification for installing these systems has returned as energy prices have increased. Our oldest APH installation is a late 1970's regenerative-type air preheater with rotating element. Our more recent APH installations are the recuperative type which eliminates the rotating element and its related reliability issues. Care should be taken to include the necessary equipment for isolating and blinding these APH installations so that the equipment can be maintained with the remainder of the heater still in service.

**Ralph Goodrich (KBC Advanced Technologies, Inc.)**

Air preheaters or steam generation are normally used to recover residual heat from the hot flue gases leaving the convection sections of most large process heaters. A single air preheater serving both the crude and vacuum unit heaters may be more economic than individual air preheaters, especially for smaller units. Generally combining services will not introduce any significant negative impacts on operability or on-stream service factor.

We have completed comparisons of air preheat versus steam generation for crude and vacuum units in the past and have concluded that an air preheat system will normally recover more residual heat from the flue gas than a conventional steam generation system. Although a lower steam pressure generation system (150 psig steam) approaches the heat recovery performance of an air preheat system, there is usually little value to the refinery to produce steam at this level. Generating a more valuable higher steam pressure (600 psig) recovers less heat, thereby increasing fuel costs.

Consideration also has to be taken into account the types of fuel that will be fired and their impact on the flue gas acid dew point and potential external fouling of the convection section tubes. As flue gas temperatures increase over time due to any fouling, not all the increased heat content in the flue gases will be recovered so the heater will have to be fired harder. Thus, the air preheat system must be compatible with the fuels as well as the range of temperatures anticipated during operation. Finally, the fired heater should be designed such that normal operations can be sustained with the air preheater out of service.

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**Jim Johnson (Marathon Petroleum)**

We utilize air pre-heating and steam generation/BFW pre-heating for flue gas heat recovery. In our most recent designs, we have determined that air pre-heat is the best option.

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