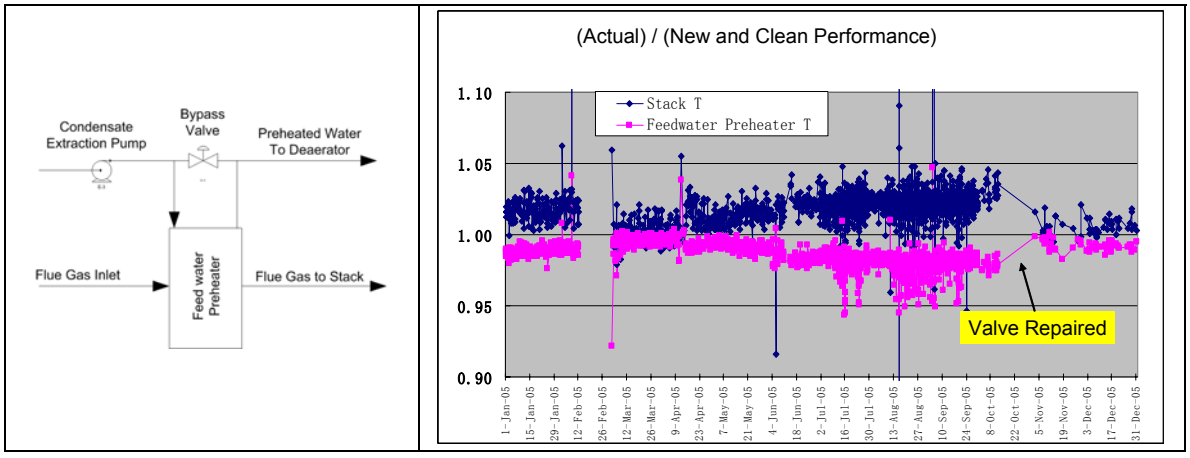
Energy auditing - why do it? Just like a motorist who finds his car petrol consumption increasing but cannot pinpoint if the problem is due to his driving habits, tyre pressure, fuel quality, uneven fuel injection, sticky brakes, faulty spark plugs, dirty valves etc. This is the same challenge facing process plant operators who sees specific energy consumption going up but do not know which are the contributing factor(s). Even worse some plant operators may not even have noticed a deterioration in energy efficiency. An energy audit will comprehensively identify the degraded plant components and their respective contribution to overall thermal efficiency loss and therefore will be valuable input into the next inspection maintenance scope to implement the necessary corrective actions.

Actsys Process Management Consultants Pte Ltd is an accredited ESCO for the process industry. Our basic approach is to use thermodynamic or process flowsheeting modeling tools to model the current performance of the plant, making use of existing flows, temperatures and pressure measurements as inputs into the model in order to quantify all current performance aspects, eg unmeasured flows, plant component efficiencies and process conditions. In order to gauge if these respective plant component efficiencies are good, another category of models are developed to calculate the "new and clean" performance for each of these plant components. By comparing the actual performance with the "new and clean" performance, the state of degradation for each plant component is known.

Tuas Power has been the pioneer amongst Singapore Power Plants in making use of such performance monitoring methodology from Actsys since more than 4 years ago, for it's 4 blocks of Combined Cycle Plants (CCP). It is one of Tuas Power's initiatives in sustaining energy efficient operation and reducing wastage through energy auditing. The initiative ensures that gaps in the performance of plant components are quantified and the necessary improvement works are scheduled at the earliest opportunity. The following case is an example of our work in Tuas Power.



The above diagram shows the feedwater preheater section of the CCP Heat Recovery Steam Generator (HRSG). By checking on a monthly basis the Actual / "New & Clean" of the flue gas and preheated water temperature coming out of the Feed water preheater (FWPH), it was detected in April a drift showing a performance gap in the FWPH. As can be seen from the plot, the temperature of flue gas to stack (losses) started to increase and correspondingly the temperature of preheated water (heat recovery) started to reduce. This early detection enabled further analyses to pinpoint the cause to the Bypass Valve which was passing and the necessary preparations to be carried out in the next turnaround opportunity. With the Bypass valve repaired, the Actual / "New

& Clean" for these temperatures went back to normal. Based on average fuel gas price and the typical 350 MW average loading of this affected CCP, this planned maintenance saved Tuas Power US$240,000 per annum fuel costs. An important point to note with such thermodynamic model based Actual / "New & Clean" analyses is that very small process condition deviations are can be distinguished from the normal fluctuations in process conditions – in this above example, the stack temperature was only 2-3 degC higher than normal. Such a level of deviation would normally have been hidden behind normal plant condition fluctuations and would not have been detected until far larger in magnitude.