CONFIDENTIAL

OSIsoft Asia Technology Conference 2007

iCON-PI Online Model for MTBE Propane Refrigerant Flaring Monitoring

Hasnor Hassaruddin B Hashim (GTS)

Low Wai Chong (GTS)

25 October 2007

PETRONAS

RESEARCH AND TECHNOLOGY DIVISION

Agendas

- Background
- Introduction to GTS
- Modeling Objectives & Challenges
- Methodology
- iCON-PI Linkage
- Findings
- Conclusions

PETRONAS

BACKGROUND

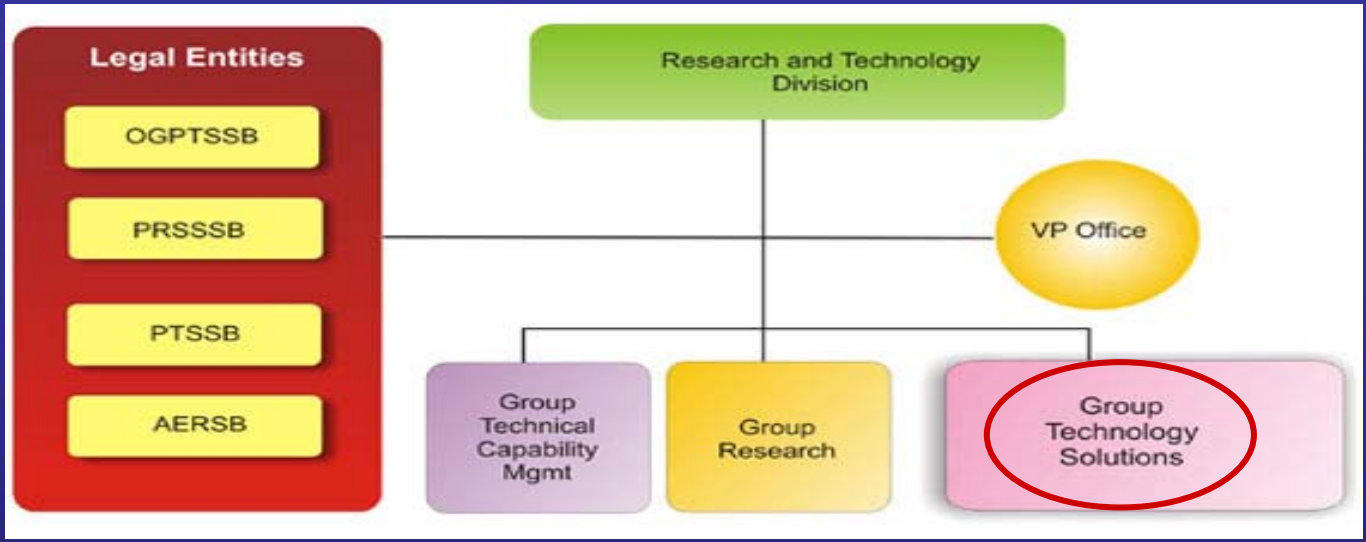
- MTBE Malaysia Sdn Bhd (MMSB) operates a world class MTBE plant in the Gebeng Industrial Area, Pahang, which produces 300,000 MTA MTBE and 80,000 MTA propylene. The plant is currently experiencing propane loss to flare from its Propane Refrigeration Loop (Unit 900).

- The Propane Refrigeration Loop is designed to provide cooling medium to MMSB plant unit operations. Currently MTBE operation is experiencing propane loses from the refrigeration loop via the pressure control valve (PC-9016) on the overhead vent line of the Propane Refrigerant Surge Drum (D-0901).

- PETRONAS Group Technology Solutions (GTS) Process Optimization Group has been tasked to simulate the propane refrigeration loop to determine the source and quantify the propane losses.

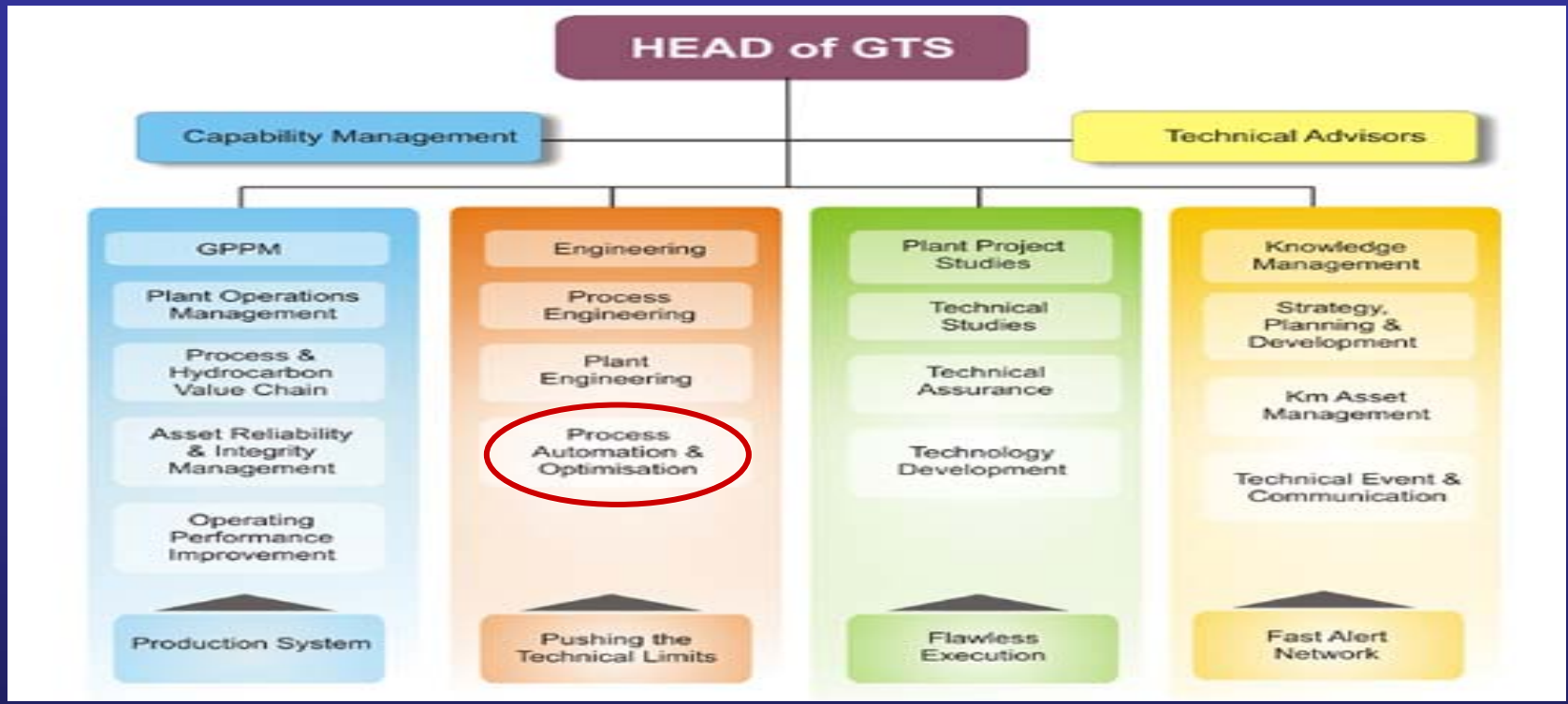
PETRONAS

PETRONAS R&T ORGANIZATION



- *PETRONAS Group Technology Solutions (GTS) was established in 2006 to serve as a one-stop centre for technical services for PETRONAS Operating Units (OPUs).*

GTS ORGANIZATION



- *Process Optimization Group (POG) resides in the Process Automation & Optimization Department and is responsible in performing process optimization studies by using simulation and APC.*

PETRONAS

WHAT DO WE WANT TO ACHIEVE?

- To study the impacts of impurities towards propane refrigerant bubble point that cause the flaring.
- To quantify the amount of flaring at downstream of Air Fin Cooler (AFC) through the accumulator vent line.
- To estimate the extra cooling duties required to eliminate propane refrigerant flaring
- To estimate the cooling water requirement for the new propane refrigerant cooler
- To illustrate the effect of ambient temperature changes towards the amount of flaring.

PETRONAS

WHAT ARE THE CHALLENGES?

- To obtain the correct composition in the propane refrigeration loop for proper bubble point prediction.
- To quantify the amount of propane losses based on control valve OP%. No flow meter on vent line.
- To link Plant Information (PI) System with iCON (PETRONAS Steady-State Simulation Software) for online modeling and monitoring to quantify the economic losses of propane flaring.

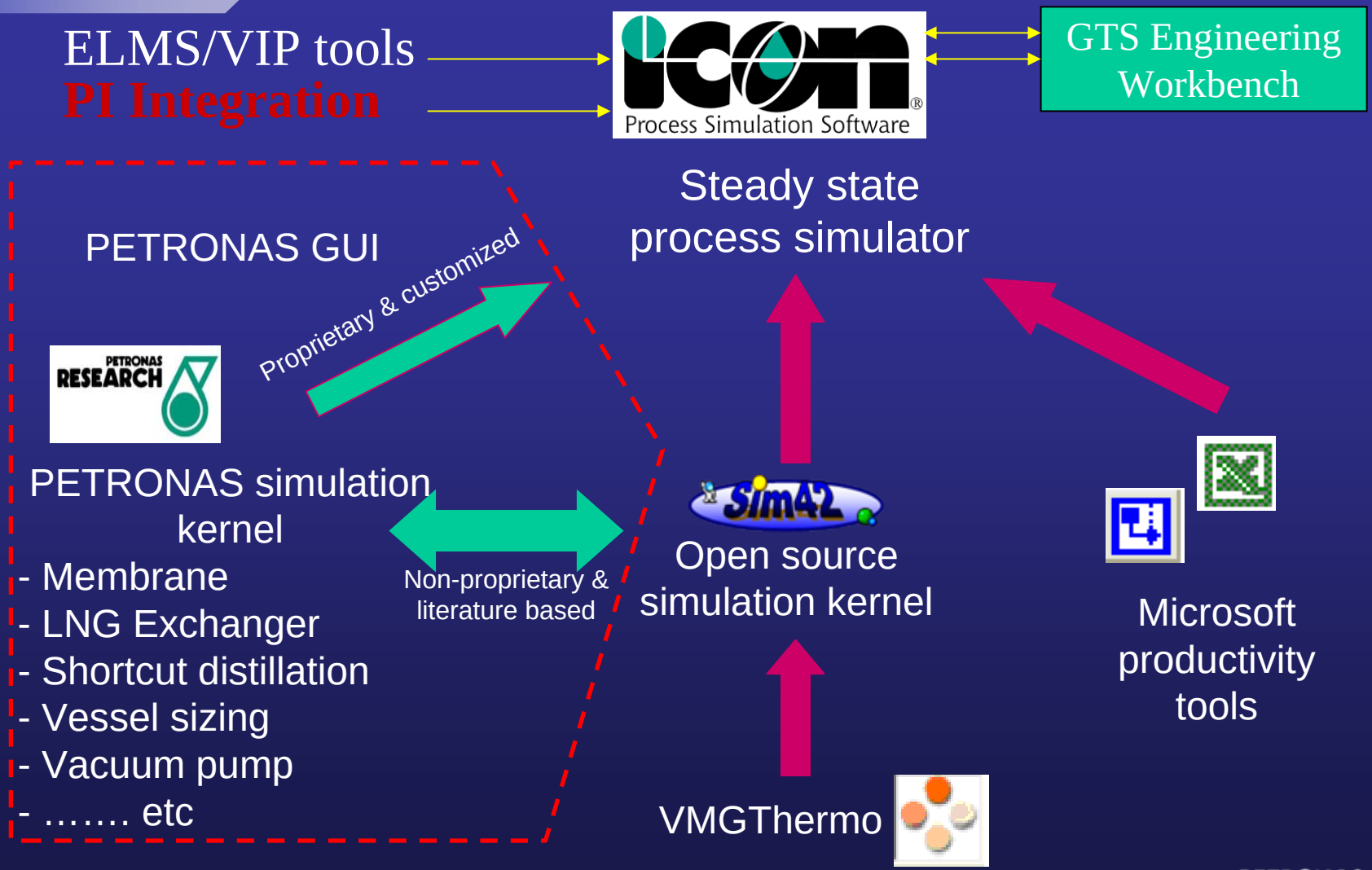
PETRONAS

WHAT IS iCON?

- iCON is the PETRONAS own Process Simulation Software which is at par with commercial process simulators (e.g. HYSYS, UNISIM, PRO-2 etc.)
- iCON was launched in 2004 and has been widely used throughout PETRONAS OPUs.
- iCON open architecture and built-in linkage with Microsoft products makes it suitable to be connected to PI for online monitoring and optimization purposes.

PETRONAS

iCON STRUCTURE



METHODOLOGY

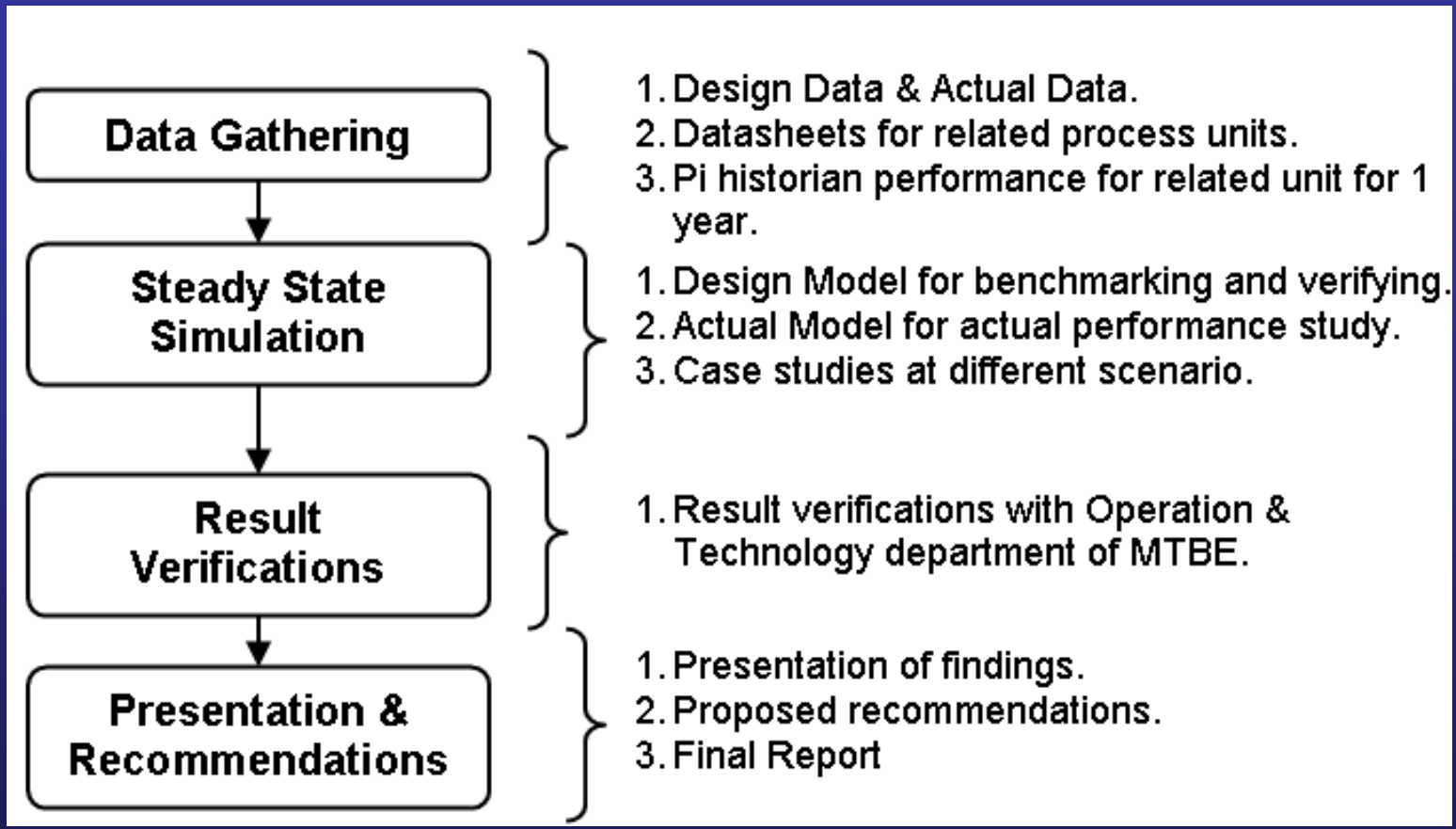


Fig. 1. Methodology Diagram

PETRONAS

SIMPLIFIED PFD

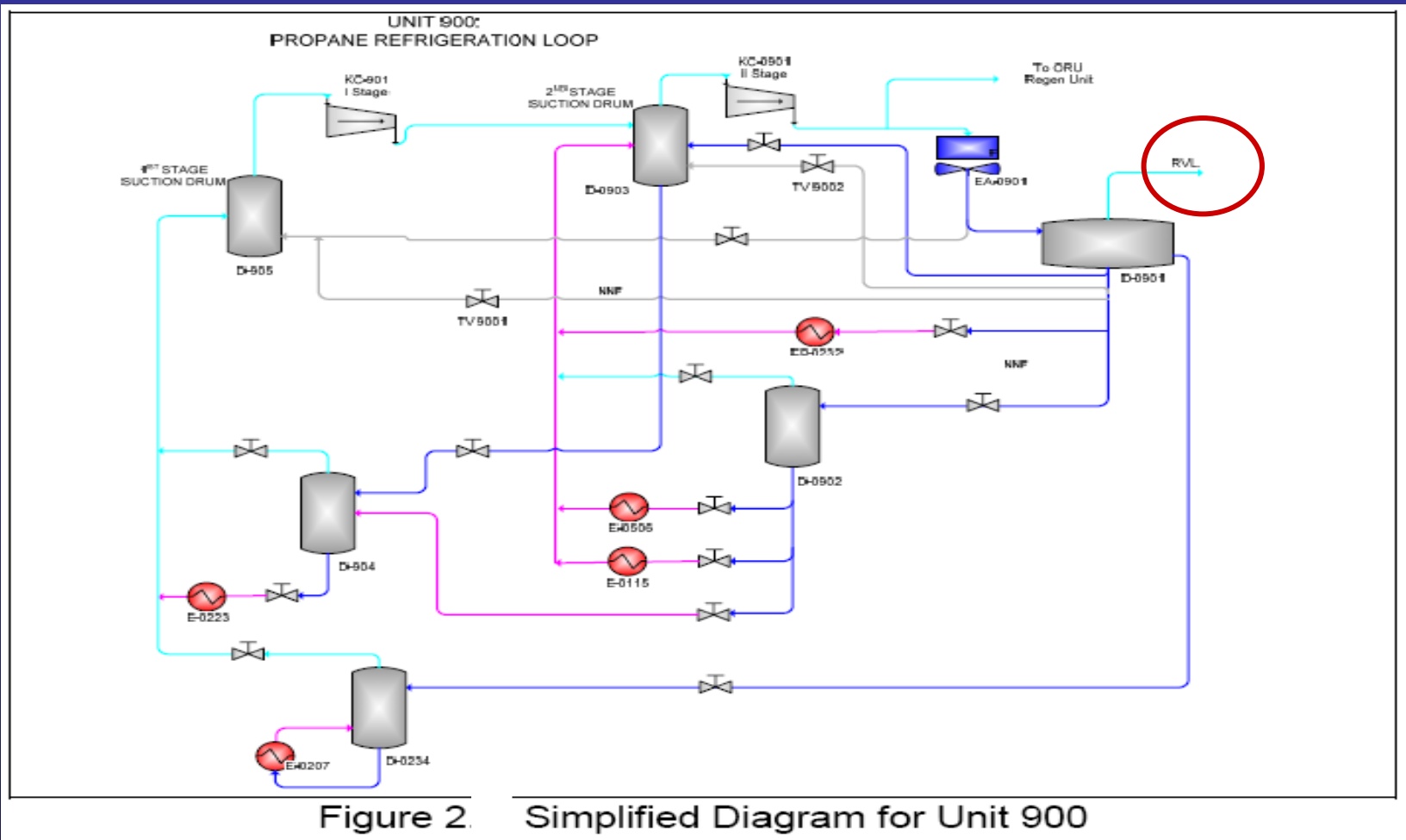


Figure 2. Simplified Diagram for Unit 900

iCON-PI LINKAGE

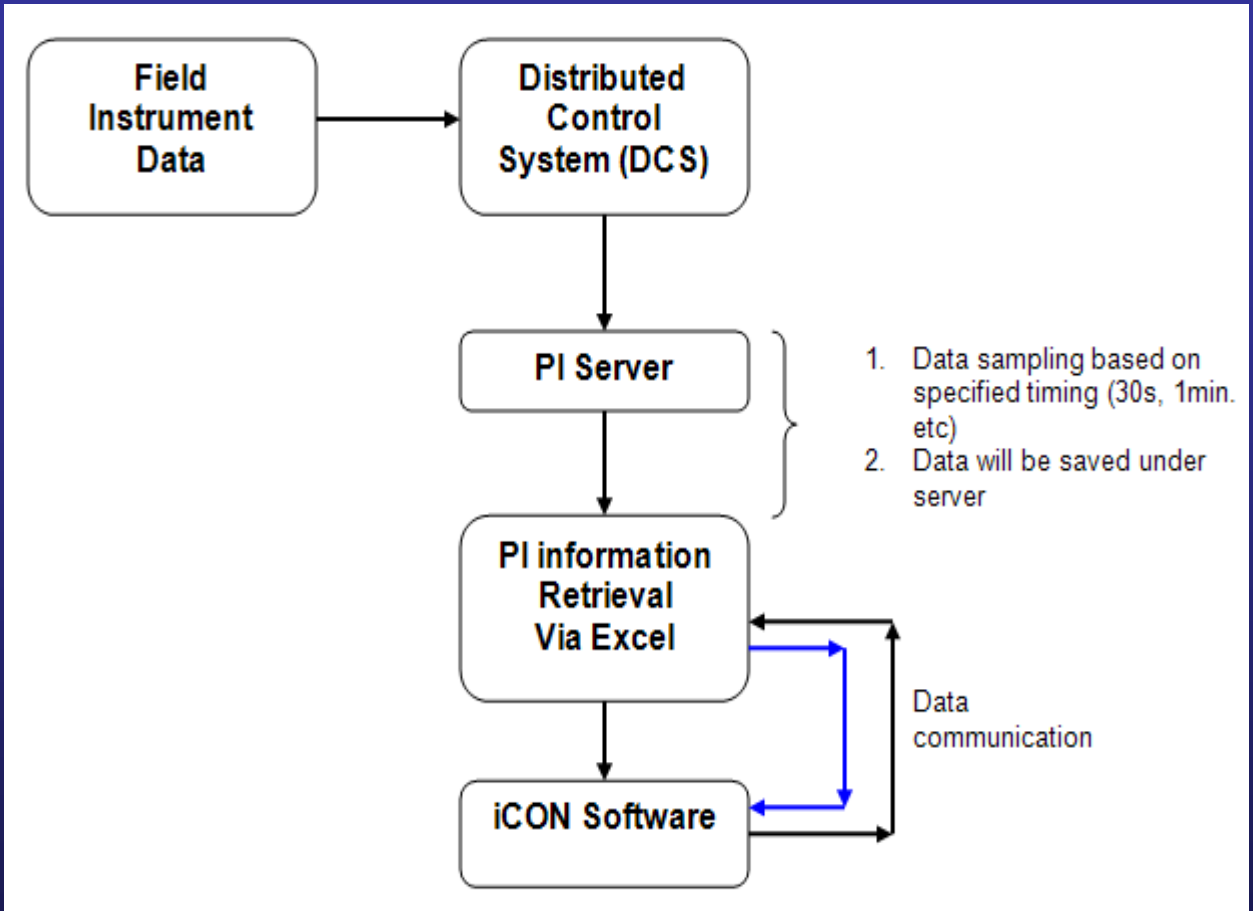
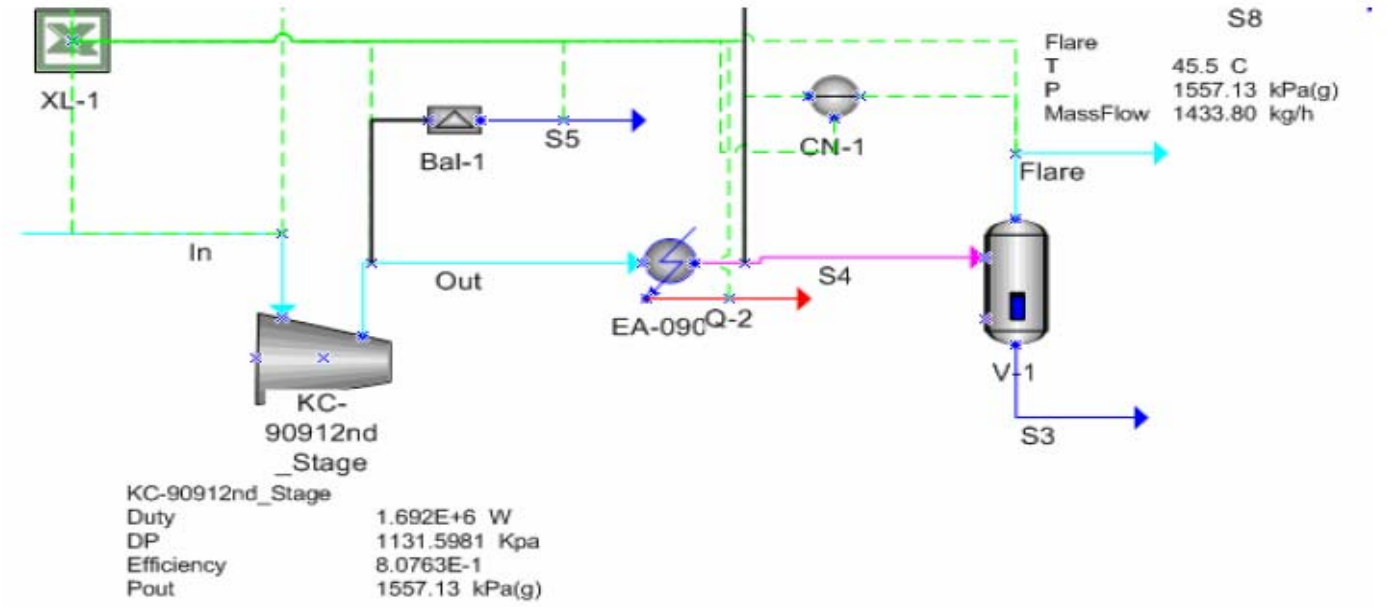


Fig. 3. Data Flow

PETRONAS

iCON-PI ONLINE MODEL



EA0901						EQ%		
	Flare OP	PC9016.OP	19.58	19.58%	%	1427.293479	kg/h	
	Outlet T			45.46	C	**Bubble Point**	**45.20**	C
				45.46				
	Actual Out T							
		TI9007	46.43	46.43	C	2.13%	Error	
		TC9007	50.50	50.50	C	11.08%	Error	
	Duty			8,067.41	kW	** Design Duty 8.586 MW*		

Fig. 4 Online Model for July Operating Condition

PETRONAS

FINDINGS (1/5)

- It is crucial to know the bubble point temperature of propane refrigerant to ensure the set point of refrigerant condenser outlet temperature is below the bubble point temperature to avoid flaring.
- Bubble point of propane refrigerant changes by +/- 2 DegC as the heavier/lighter impurity increases (+ 2 mol %) at a given pressure

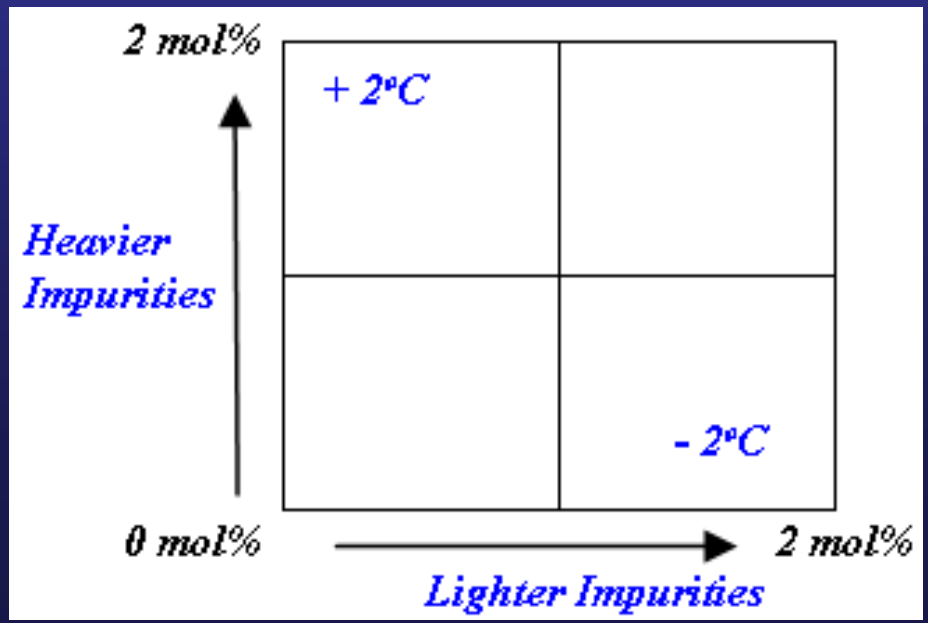


Fig. 5 Bubble Point changes against heavier and lighter impurities

PETRONAS

FINDINGS (2/5)

- The actual duty of Air Fin Cooler (AFC) can be calculated based on the vapor fraction specification outlet of the equipment.
- This is due to high discrepancies of temperature readings between 2 transmitters at downstream of AFC.

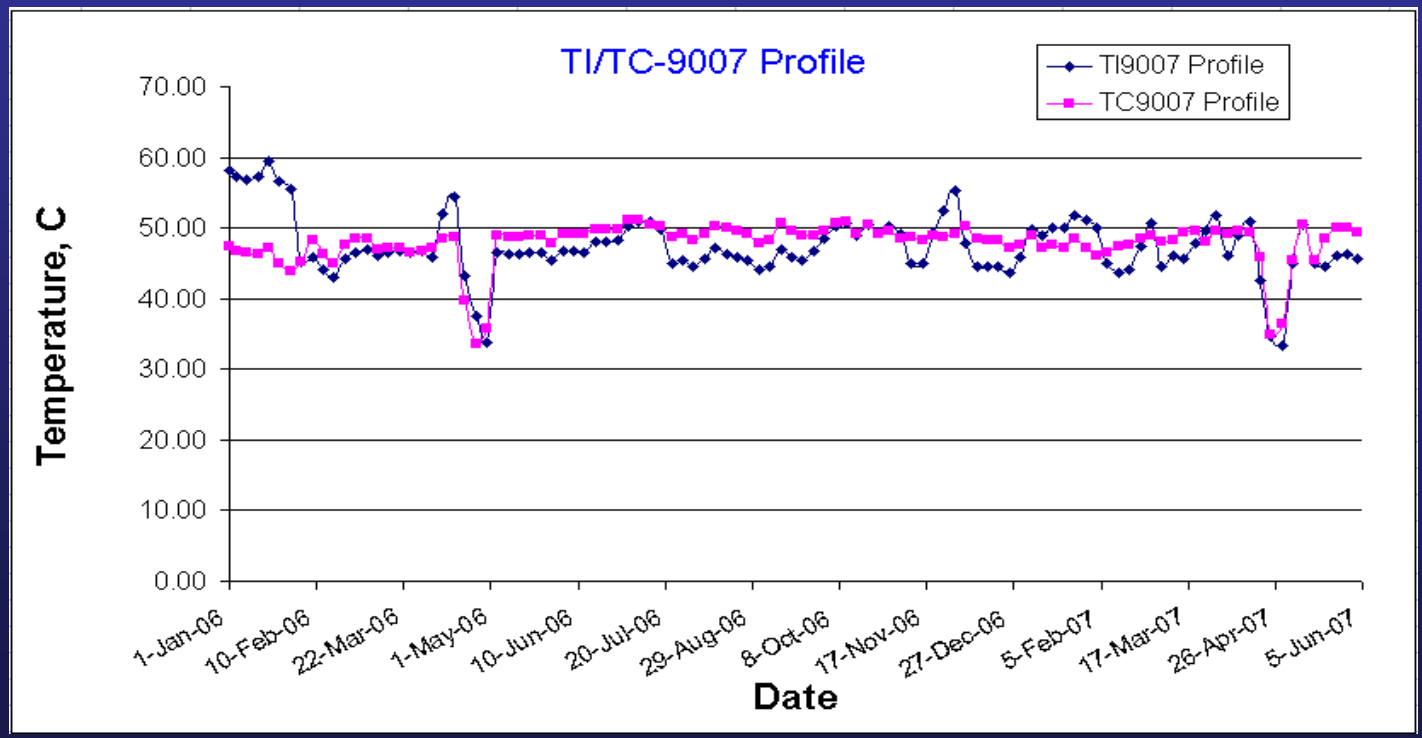


Fig. 6 Discrepancy between 2 temperature transmitter readings

PETRONAS

FINDINGS (3/5)

- The minimum amount of extra duty required is obtained via the iCON-Pi Model.
- The cooling water amount needed for a new trim heat exchanger is determined based on the simulation result.

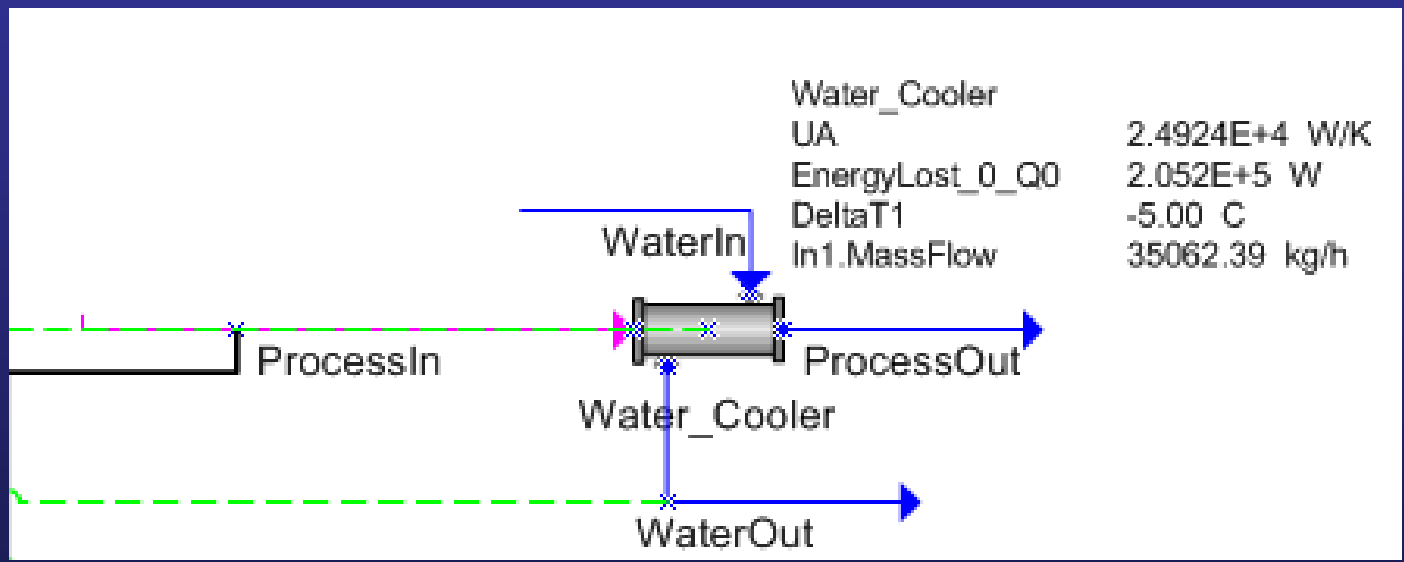


Fig. 7 Using of Online Model to Compute Extra Duty Needed

PETRONAS

FINDINGS (4/5)

- Slight changes of ambient temperature drop can provide the extra cooling required to overcome the flaring at refrigeration loop. This explains why the most of the flaring occurs at noon where the ambient T is the highest.

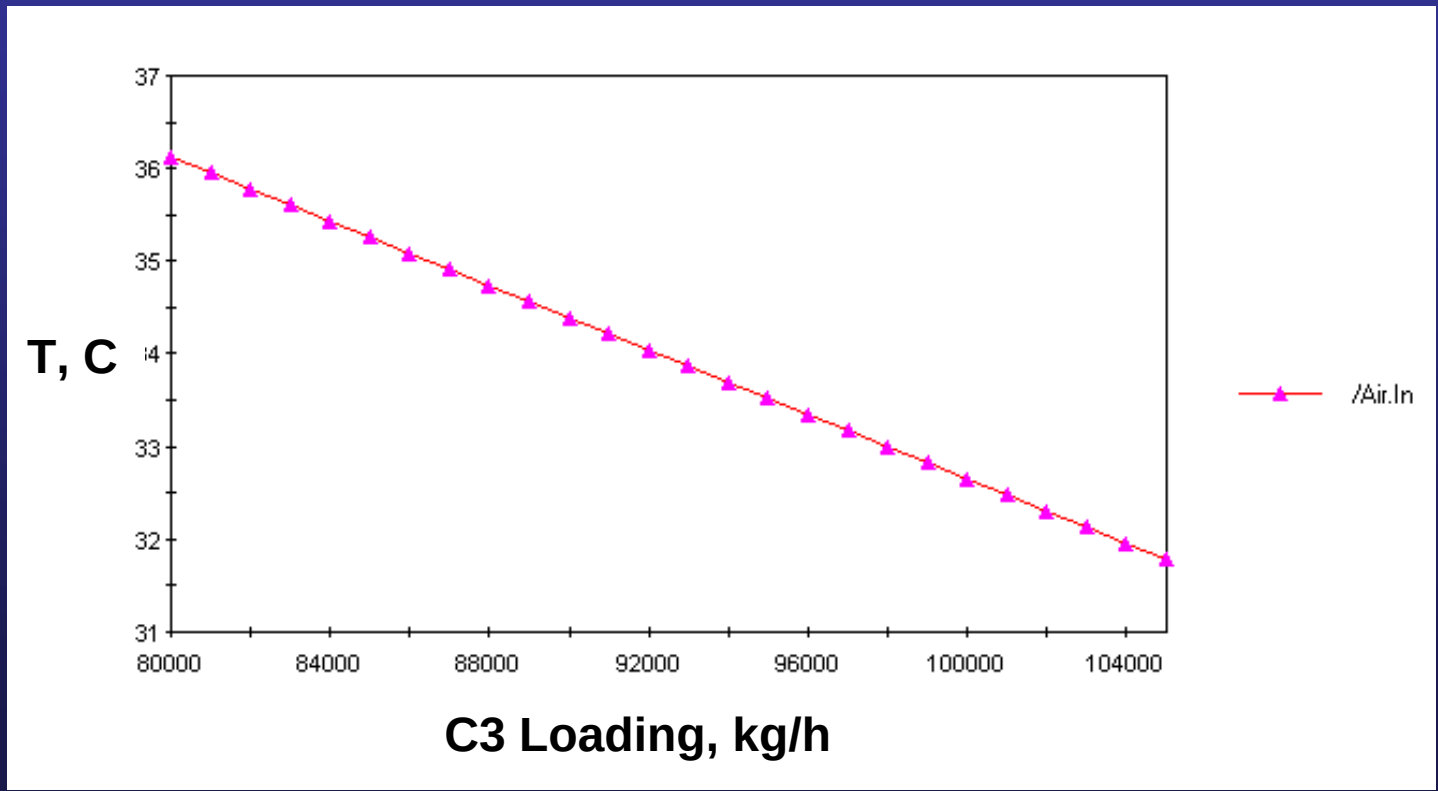


Fig. 8 Using of Online Model to Compute Extra Duty Needed

CONCLUSION

- iCON-PI online model is able to be used for monitoring of AFC performance, refrigerant bubble point temperature and flaring economics.
- Seamless data transfer between iCON and PI via Microsoft Excel due to built-in linkages.
- iCON adds extra calculation capability to PI especially for thermo-physical properties prediction.
- Way-forward: GTS and MTBE will embark on a PI Enhancement Project later this year where material and energy balances, and energy index calculation will be developed by utilizing iCON and PI, and will be displayed to the operators to ensure optimum plant operation.

PETRONAS

THANK YOU

PETRONAS