

# VISIT TO TUANKU JA'AFAR POWER STATION, PORT DICKSON



by Ir. Dr. Oh Seong Por

On 7 October 2019, The Institution of Engineers, Malaysia, Negeri Sembilan Branch (IEMNS) organised a technical visit to Tuanku Ja'afar Power Station (TJPS) in Port Dickson. Led by IEMNS Chairman Ir. Dr. Oh Seong Por, the 54 participants, comprising members from IEMNS, local industries, Technical Association Malaysia (TAM) and students, spent half a day touring the iconic station.



The Tuanku Ja'afar Power Station in Port Dickson

The group arrived at the station at 10 a.m. and was greeted by Ir. Mohd Zaidy bin Mat Rajali (manager, Customer Service) who introduced the station's top management team members - Enck Zulkifli bin Jaafar Sidek (head of TJPS), Ir. Muhammad Azhari bin Mustaffa (head of Production), Encik Mohd Annuar bin Mohd Yusoff (senior manager, Business & Support) and Ir. Prem Rakesh (staff engineer).

The participants also enjoyed a tea reception before they were ushered to the conference room where Encik Zulkifli gave a brief explanation about the station. He said TJPS was established in 1969 as a conventional thermal power plant that used fuel oil to generate 600MW. In 2000, the plant was rehabilitated in stages and replaced with a combined cycle which fired natural gas supplied by Petronas and was supported by distillate (diesel) as standby fuel.

The 1st stage (PD1) was commissioned in 2005 and the 2nd stage (PD2) was completed in 2009. The combined power generation design capacity is 1500MW. Encik Zulkifli explained that sea water is pumped into the station and used to cool the condenser of the steam turbine system as well as the closed-circuit cooling of equipment. The sea water passes through the equipment and is discharged back into the sea at higher temperatures of 36-37° Celsius but without disrupting the marine eco-system.

He said the TJPS management places top priority on keeping the workplace safe and on protecting the environment, including managing nitrogen oxide NOx emission at 25ppm which is much lower than the permissible limit set by the Department of Environment.

Then Ir. Prem Rakesh presented the technical aspect of the station (as illustrated in Figure 1).

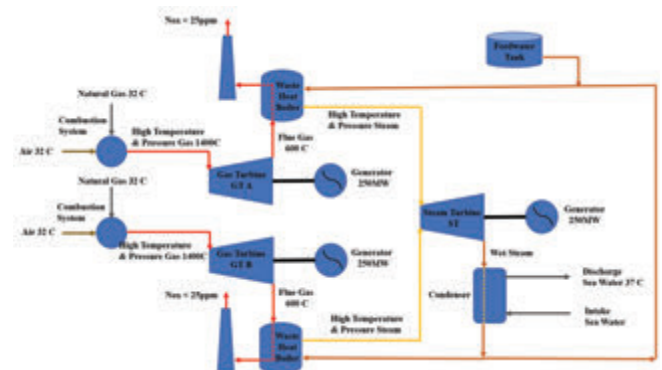


Figure 1: The TJPS Power Generation System

Each PD1 and PD2 has 2 gas turbines (GT A and GT B) and a steam turbine (ST) to turn separate generators. Compressed air and fuel (natural gas) are combusted to produce high temperatures (1400° Celsius) and high pressure gas, sufficient to turn the gas turbine to run the generator. Flue gas that leaves the gas turbine has a huge pressure drop but the temperature is relatively high at 600° Celsius. It is directed to the waste heat recovery boiler to

bring up superheat steam which is used to drive the steam turbine and generator.

In short, there are 2 stages of power generation: The 1st stage uses gas turbines and 2nd stage uses a steam turbine. The gas turbine and steam turbine generator are designed to produce 250MW. Therefore, PD1 and PD2 can generate 750MW each and the total combined power generation of TJPS is 1500MW. The average voltage generated is 15kV and this is stepped up to 275kV before it is supplied to the national grid. Table 1 shows the important assets of PD1 and PD2.

Plant	Asset	Specification	Manufacturer	Year	Current Output
PD1	Gas Turbine GT1A	M701F3, 250MW	Mitsubishi Hitachi Power	13 <sup>th</sup> June 2005	226MW
	Gas Turbine GT1B	M701F3, 250MW	Mitsubishi Hitachi Power	13 <sup>th</sup> June 2005	220MW
	Steam Turbine ST1		Mitsubishi Hitachi Power	13 <sup>th</sup> June 2005	250MW
PD2	Gas Turbine GT2A	9FA3, 250MW	General Electric	24 <sup>th</sup> Jan 2009	222MW
	Gas Turbine GT2B	9FA3, 250MW	General Electric	24 <sup>th</sup> Jan 2009	222MW
	Steam Turbine ST2		Toshiba	24 <sup>th</sup> Jan 2009	250MW

Table 1: Major assets of PD1 and PD2

After the presentation, the participants were divided into two groups to minimise congestion when entering power generation line. They were guided to see in closer detail the important processes and assets that were presented earlier. The first stop was the sea water intake station. Net filter systems are used to prevent fish from being sucked into the cooling system.

The power generation system is a compact integrated type comprising combustion chamber, compressor, gas turbine and generator. The system is monitored around the clock by technicians and engineers inside the central control room. According to Encik Mohd Annuar, the controlling technicians need to be trained constantly

to maintain competency. Training is carried out in the simulator at the Excellence Development Centre inside the station.

With improved technology and higher automation, the station can be managed by only 170 personnel. The waste heat recovery system is a gigantic multi-storey steel structure that allows for vertical flue gas flow where heat is transferred to generate superheated steam.

The last stop was the sea water discharge station where we saw the clean water rushing back to the sea, whirling and leaving long trails of white bubbles. Although the station was rehabilitated 15 years ago, the assets and buildings were well maintained and clean with a pleasant environment. Without doubt, this fits the TJPS slogan: "A Great Place Where We Enjoy Working Together".

The participants were then invited to a group photo session with the TJPS management team at the front of the administration building before they departed at 1 p.m. They expressed satisfaction about the visit and left with a good impression of TJPS.

Meanwhile, Ir. Dr Oh Seong Por stayed on to deliver a 2-hour talk on The Route to Professional Engineer to the young engineers of TJPS, in a reciprocal gesture for the warm hospitality shown by TJPS. ■



The TJPS management team and the participants



Ir. Prem Rakesh guiding the participants on a tour of the facilities



In the Central Control Room



In the conference room: Front row (left to right) Ir. Muhammad Azahari bin Mustaffa, Encik Zulkifli bin Jaafar Sidek, Ir. Dr Oh Seong Por and Ir. Mohd Zaiddy bin Mat Rajali