TNB RESEARCH

Innovate With The End In Mind

"TECHNICAL FEASIBILITY OF CO-FIRING AMMONIA AND SUB-BITUMINOUS COALS IN A PILOT-SCALED COMBUSTOR"

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Overview

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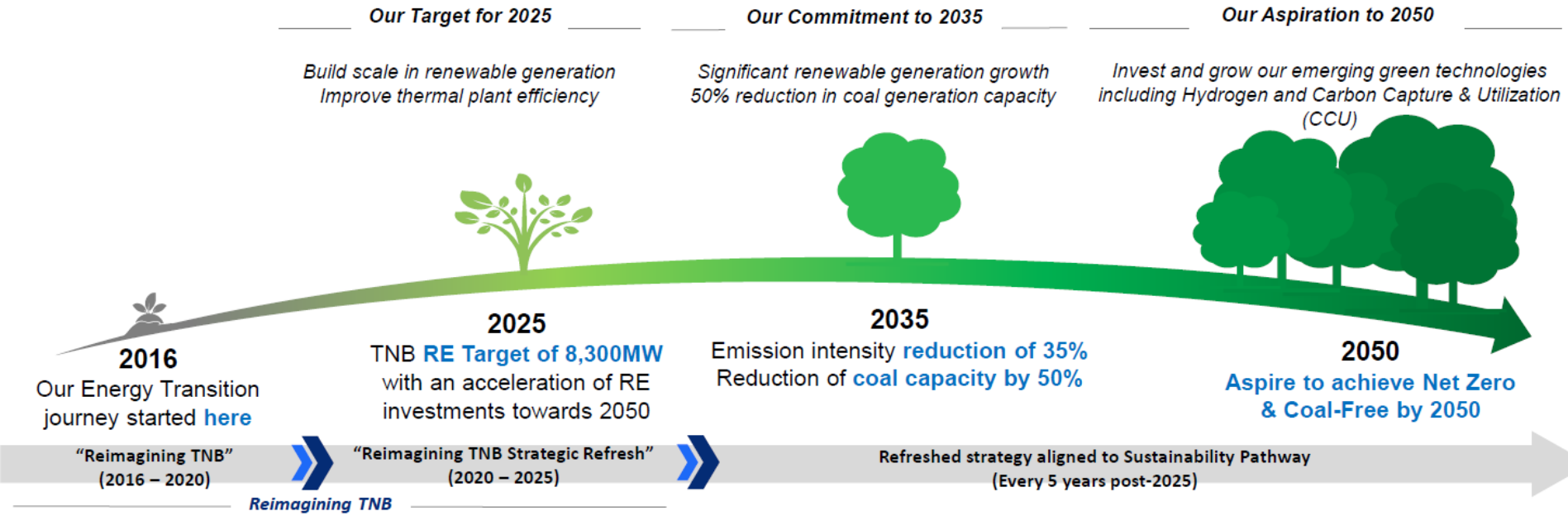
We believe that our sustainability pathway towards 2050 will open new growth opportunities whilst remaining true to our core role

Target of 8.3GW RE by 2025
Commitment of 35% reduction of our emission intensity by 2035
Aspire to achieve Net Zero emissions by 2050



Our journey for the next 5 years is still guided by Reimagining TNB – **the medium term goals to 2025 still remain**

Our case study:

Demonstration of the technical feasibility of co-firing ammonia at TNB Research combustion test facility involved three parties

PETRONAS

IHI

TENAGA NASIONAL
Better. Brighter.

- To supply Ammonia for co-firing assessment
- Provide technical advisory on feasibility of Ammonia co-firing
- Execute pilot scale testing for co-firing assessment

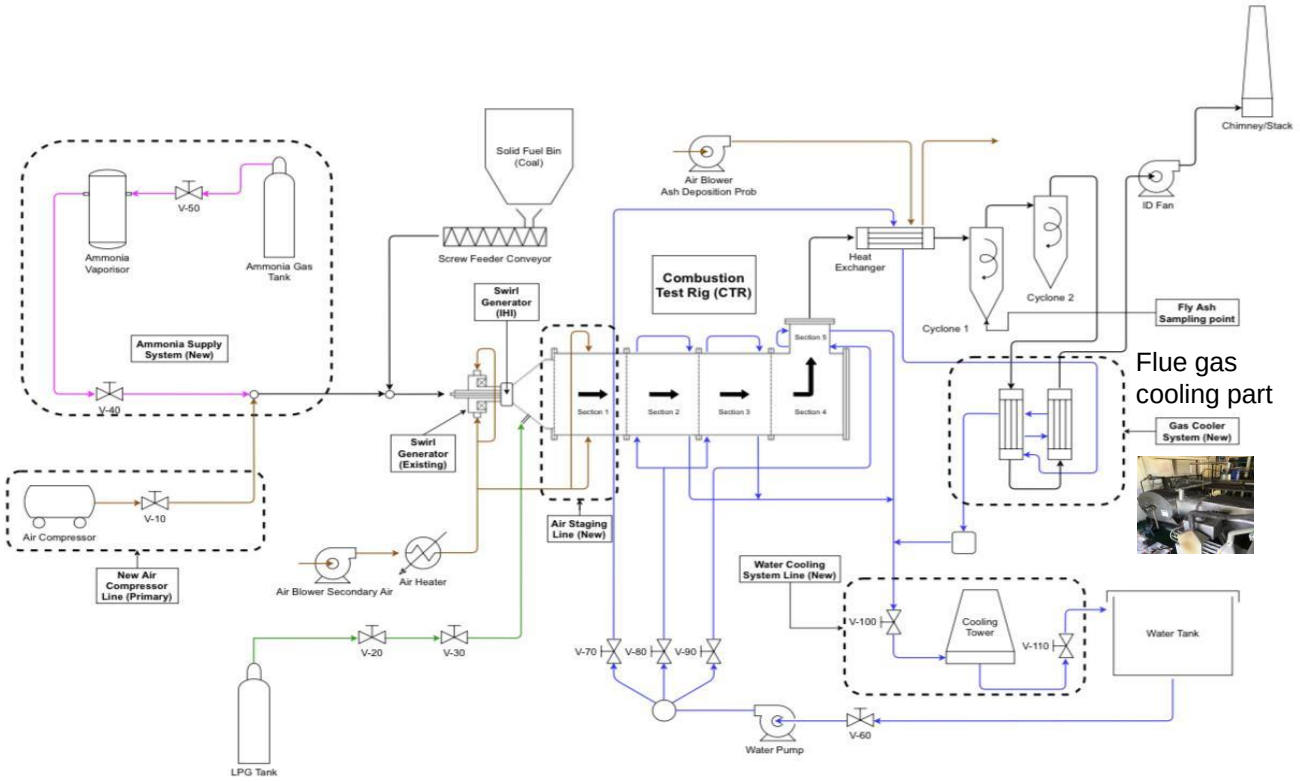
Key aims are

(i) To determine what are the conditions required for the reduction of emission release in ammonia co-firing

(ii) To obtain the flame temperatures for insights on in furnace real time monitoring

(iii) To ascertain unburnt carbon reduction in ammonia co-firing.

TNBR Combustion Test Rig for Ammonia co-firing testing programme



A total set of 6 testing conditions were established whereby each conditions was conducted daily:

- Melawan Coal single firing
- Melawan – ammonia co-firing
- SM Coal single firing
- SM Coal – ammonia co-firing
- MHU Coal single firing
- MHU Coal – ammonia co-firing

- To obtain swirl air flow, swirl vane was installed into the combustion air flow; The swirl intensity influence the NOx emissions; a pulverised coal flame is established
- LPG is used for support fuel to maintain the furnace temperature
- In all ammonia co-firing conditions, leakage ammonia was checked using a detector tube and was not detected in any case (0 ppm).

Equipment parameter	Capacity	Remarks
Ammonia flowrate	0 - 10 kg/hr	Depends on testing condition
Primary air flowrate	9 Nm^3/hr	Fixed throughout this programme
Coal flowrate	0 - 40 kg/hr	Depends on testing condition
Secondary air flowrate	0 - 150 Nm^3/hr	Depends on coal properties
Staging air flowrate	0 – 45 Nm^3/hr	Typically 0%, 30%, 40%
LPG flowrate	2 kg/hr	Fixed throughout this programme


Burner part


Section 1


Section 2, 3, 4

Conclusions

- Assessment on co-firing impact was successfully carried out whereby the flame temperature as in furnace real time monitoring for both single and ammonia co-firing conditions for all the tested coals do not vary significantly.
- Reduction of CO2 and SO2 emissions were achieved when firing the coal: ammonia 40:60 ammonia, while the increasing of NOx was found to be under controlled through staged combustion application.
- No ammonia slip was found at the furnace exit throughout the testing programme.
- However, future research is needed to determine the optimal method of NOx reduction.

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Thank You

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