INTEGRATED ENGINEERING SOLUTION

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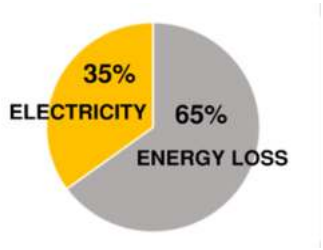
The Introduction of Combined Heat and Power (CHP)

Climate change has been an ever-pressing concern globally, causing adverse effects on public health, biodiversity, economy and the list goes on. To address the issue, more than 70 countries, including influential countries – China, the United States and the United Kingdom, have committed to net-zero emissions, earliest by 2050.



Currently the global energy mix (electricity, transport and heat) is still dominated by fossil fuel, amounts to over 80%. Hence low carbon technology is gaining traction to achieve energy transition. The major drawback of conventional centralised power generation lies on the low system efficiency, around 35% of the fuel energy to delivered to end user via electricity, due to losses in power generation through heat and electrical transmission, Fig 1.

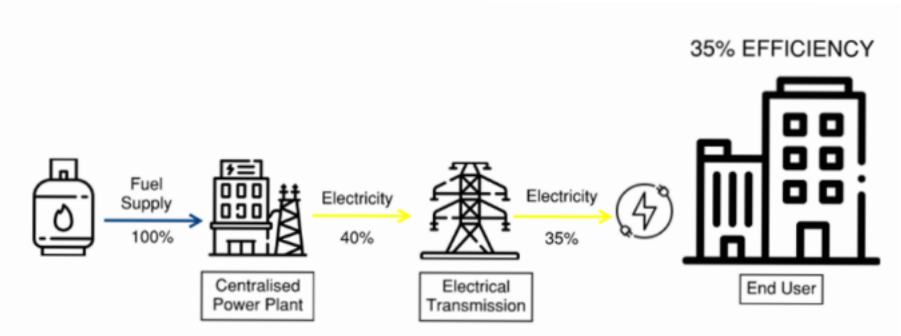


Fig. 1 Conventional Centralised Electrical Transmission

Combined Heat and Power (CHP) offers an alternate solution which mitigates the energy inefficiency of conventional centralised power generation by congregating heat and electricity. Fig. 2 shows a generic

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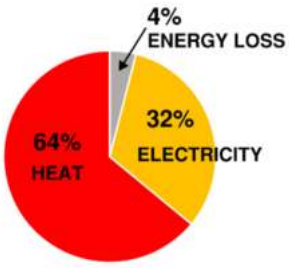
schematic of a CHP. Fuel is combusted in the internal combustion engine (ICE), which drives the generator and produce electricity. On the other hand, the by-product, exhaust gas, is recycled using a heat recover unit, which extracts the waste heat for space heating and hot water production.



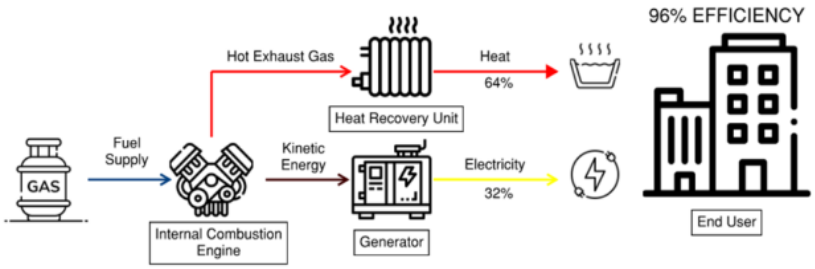


Fig. 2 Generic Schematic of Combined Heat Power (CHP)

CHP system provides a decentralised energy supply which eliminates losses through electrical transmissions and improve the system's energy security. In addition, the waste heat from the CHP can be recovered and used efficiently due to proximity of the localised CHP plant compared to conventional centralised power plant, whereby waste heat cannot be transported economically for long distance. As a result, CHP plant can reach up to 96% total system efficiency (thermal and electrical).

Cogenerating thermal and electrical power allows two operating modes, heat-lead mode and electrical-lead mode. The CHP unit will adjust its operation based on the heating demand and electrical demand, respectively. However, the shortcoming is the inability to fully utilise the potential of the CHP unit, as thermal and electrical demand is often mismatched. To mitigate, an adaptive control and modulation system along with thermal storage management system may be applied to optimise the user profile in real time. The system modulates according to the demand, allowing the CHP to work at highest efficiency from part load (as low as 50%) to full load (100%).

What's Next

Backflushing for Heat Exchangers