Analysing the use of waste factory heat through exergy analysis

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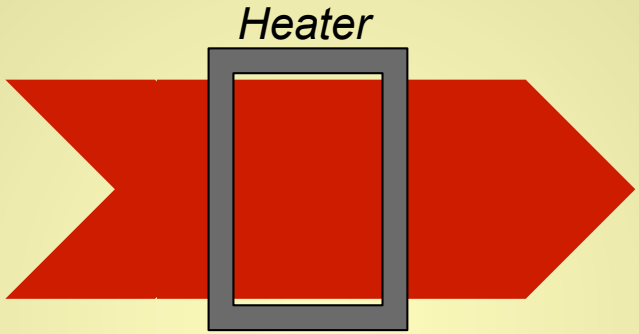
Why is exergy important?

- Definitions of ENERGY:
- *The property of matter and radiation which is manifest as a capacity to perform work (Oxford dictionary)*
- *Ability of a system to do work*
- Really?

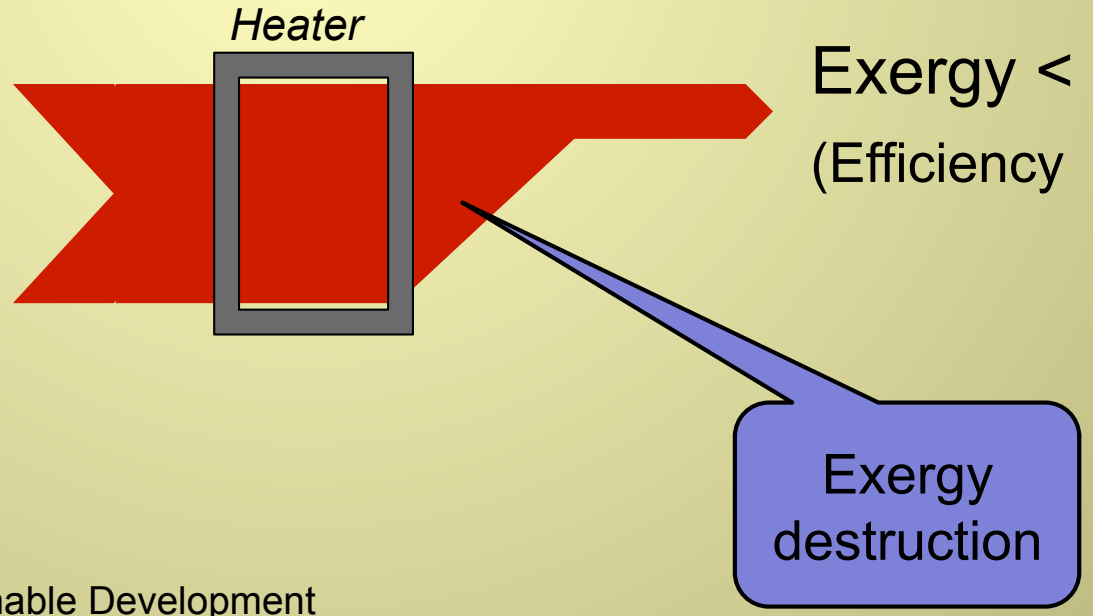
Energy transformations and loss of quality
Example – simple electric heater

Energy 100 J
(electrical)



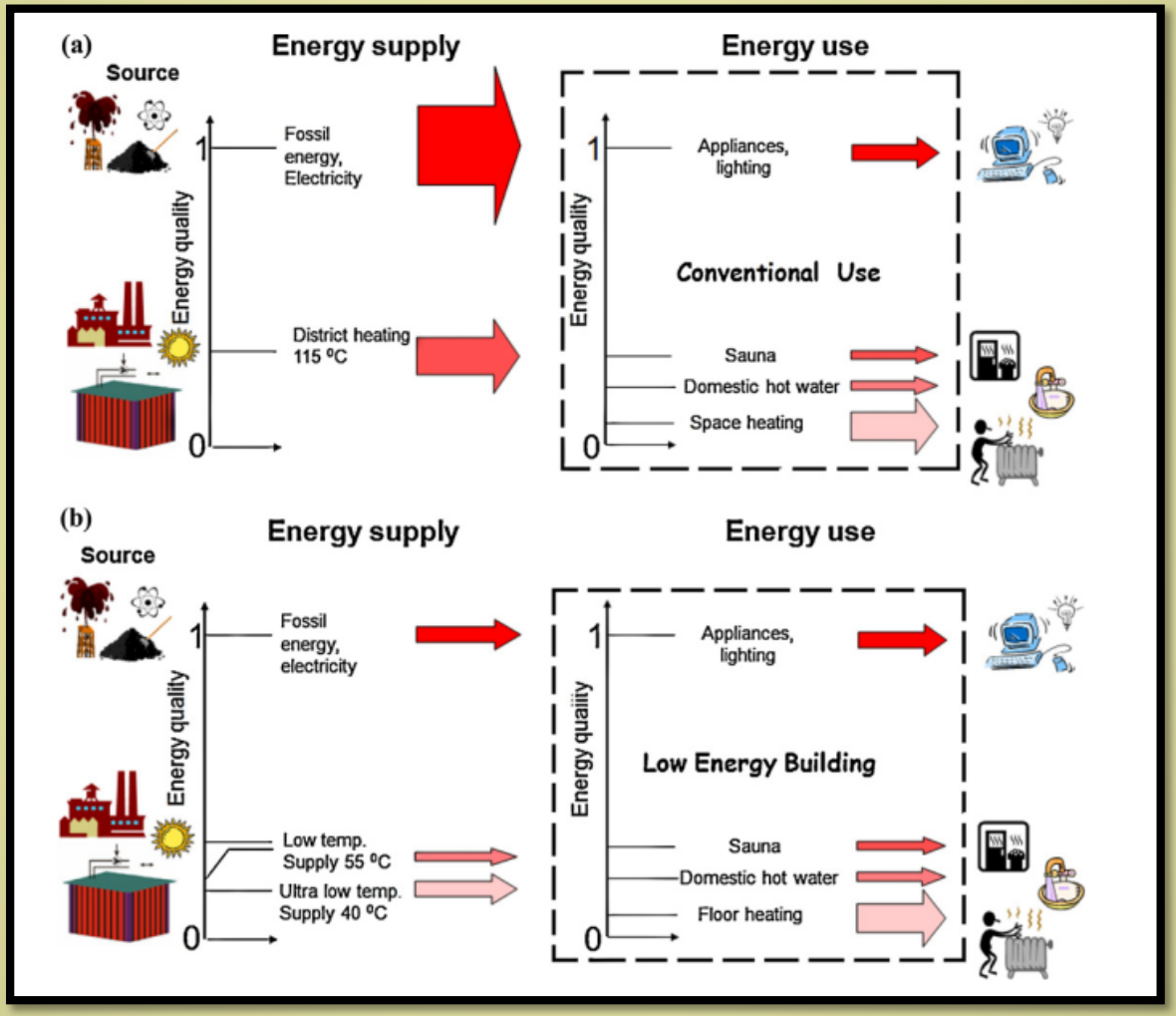
Almost 100J low grade heat output
(Efficiency ≈100%)

Exergy 100 J
(electrical)



Exergy < 10J
(Efficiency <10%

Matching energy quality supply and demand in a building

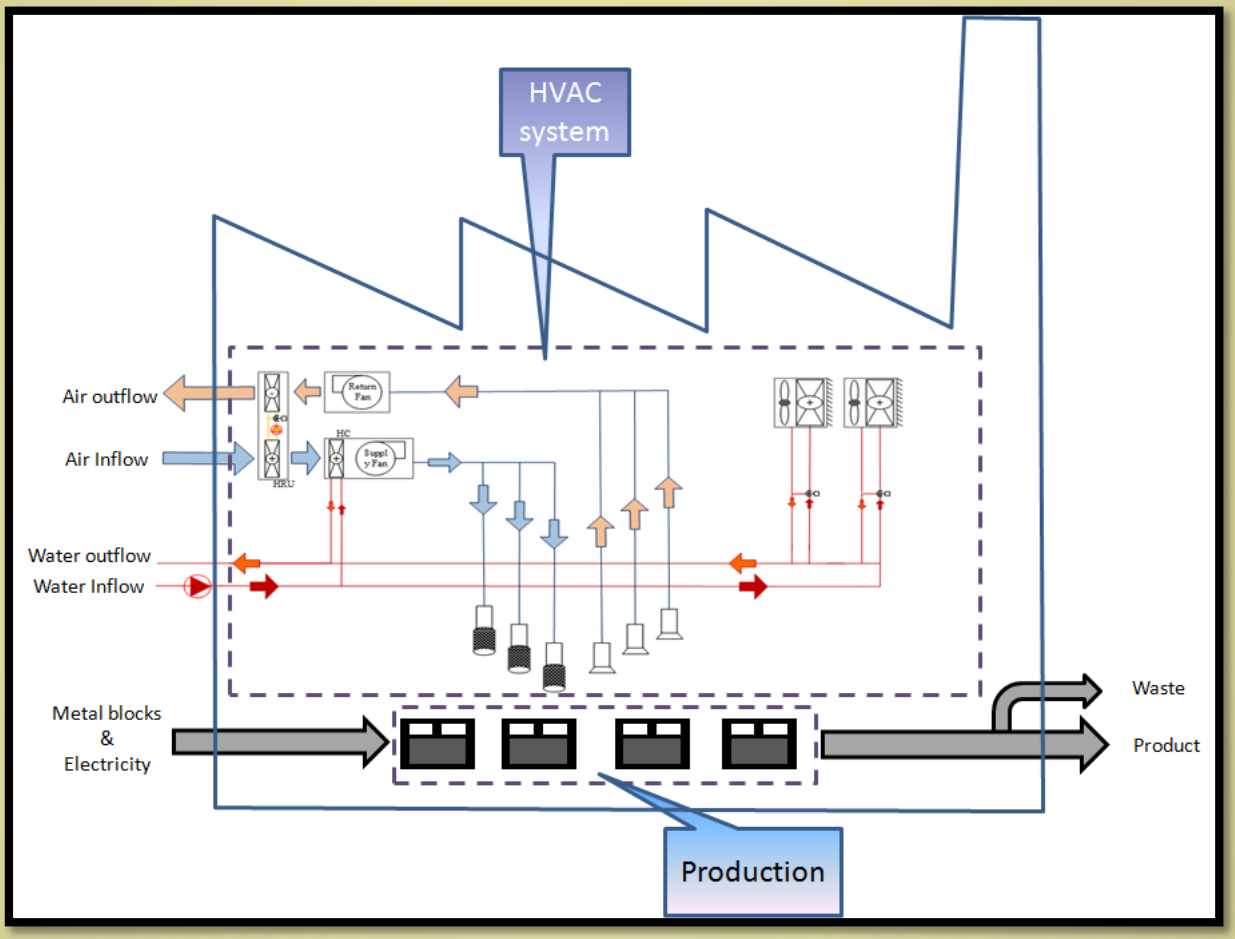


Energy quality schematic (a) conventional use (b) Low energy building with supply and demand quality matching. Source(Hepbasli, 2012)

Case study – Factory heat reuse

- Automotive cylinder head manufacturing line
- The factory HVAC system reuses building factory heat
- The HVAC system energy and exergy efficiency quantified
- Exergy destruction quantified
- Why?

Control Volume depicting the factory



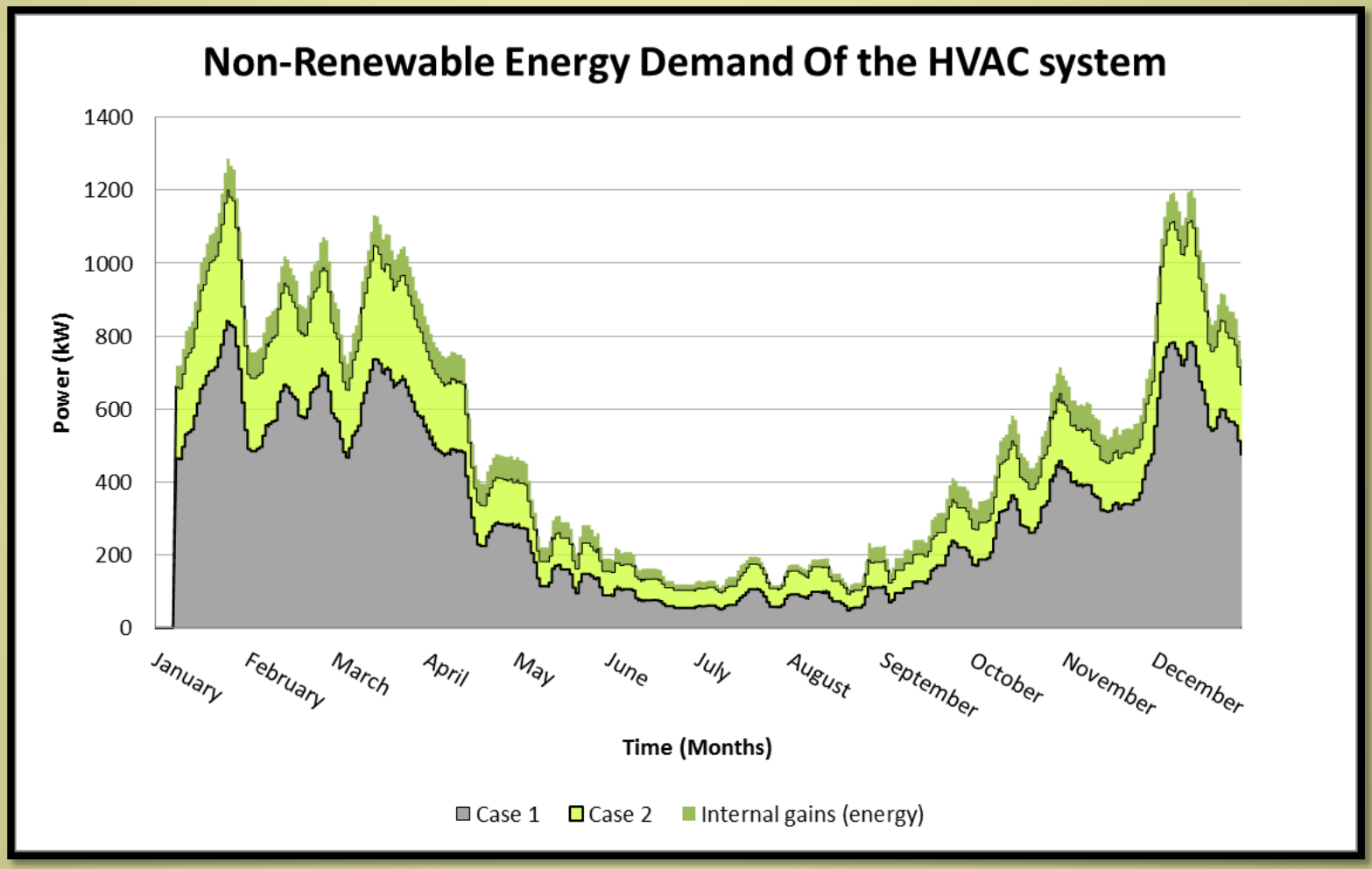
HVAC system reuses exhaust building heat

Analysis approach

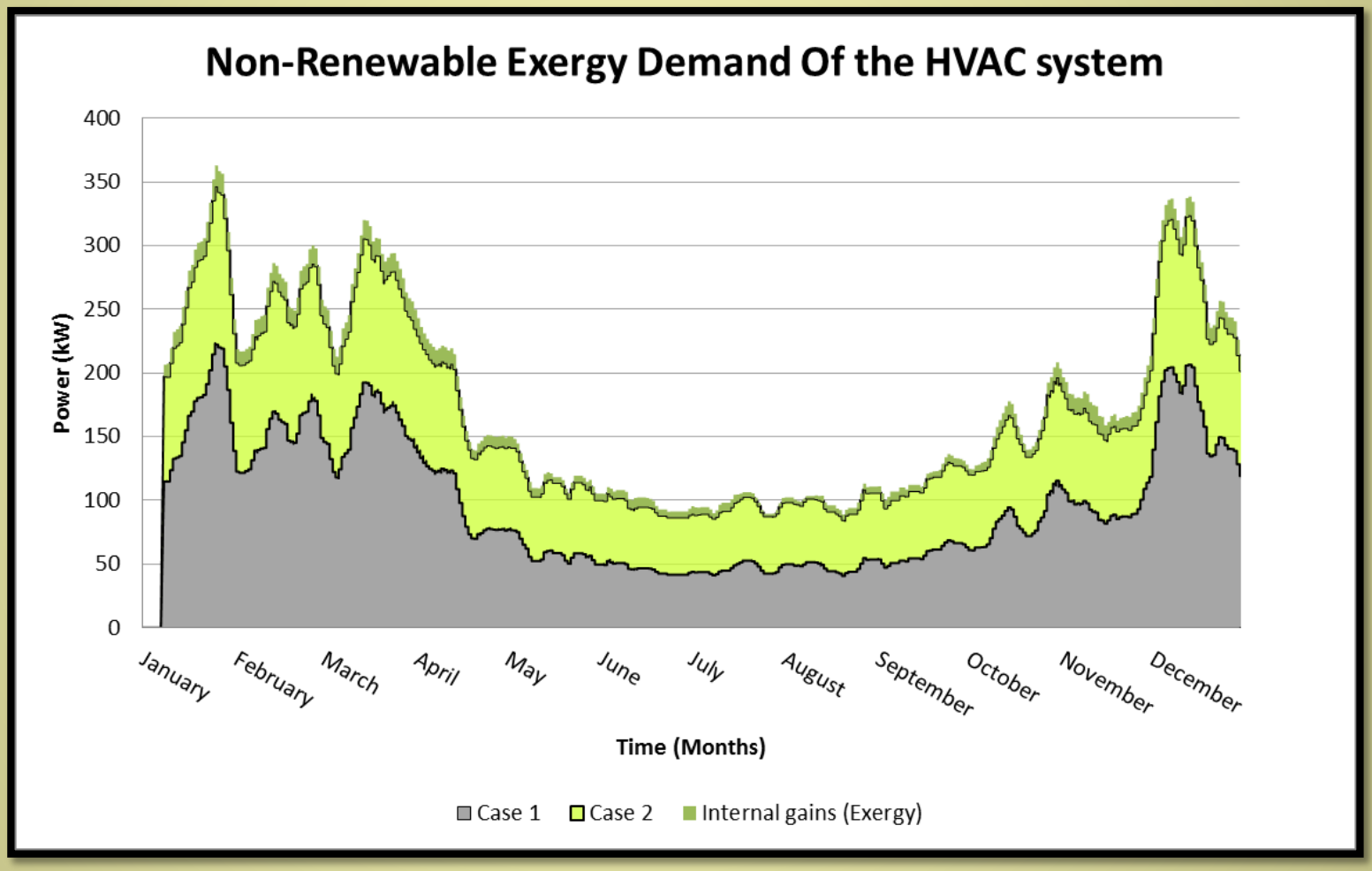
- Factory **with heat reuse** (Actual case)

  Compared to the factory **without heat reuse** (Simulation, E+)
- Exergy analysis conducted
- Quantifying effect of technology on resource efficiency

Energy demand comparison



Exergy demand comparison



Summary of yearly results

	Energy demand (MWh/year)	Exergy demand (MWh/year)	Exergy destruction (MWh/year)
Without heat reuse	2962	851	732
With heat reuse	1329	627	581
Improvement	55.13%	26.3%	20.6 %

Summary

- Low grade heat is reused to reduce usage of a higher grade heat.
- Energy quality supply-demand matching.
- The reduction in exergy removal from supply resource quantified.
- No extra data in addition to an energy analysis required!
- Low level of complexity in exergy calculations