

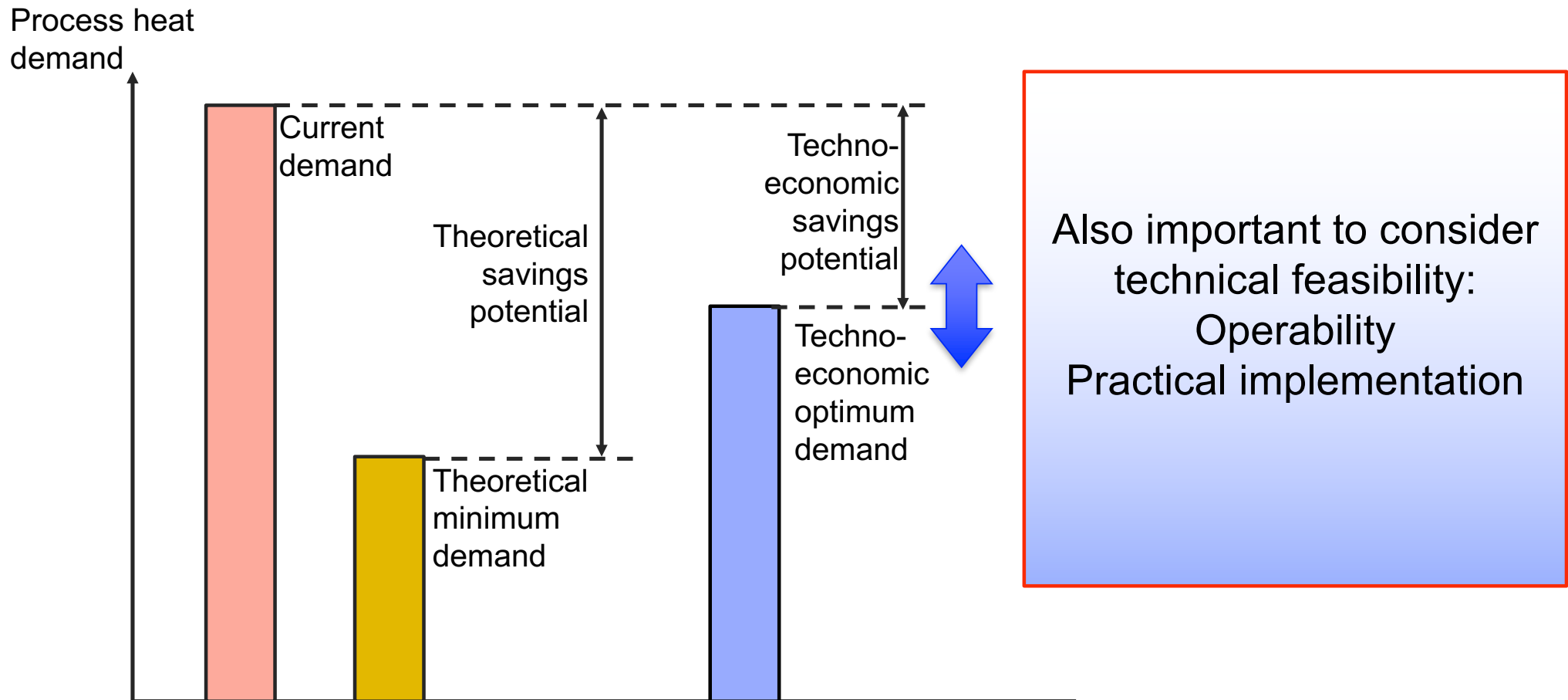
# Non-energy benefits of heat integration retrofits

Case study at a large oil refinery in Sweden

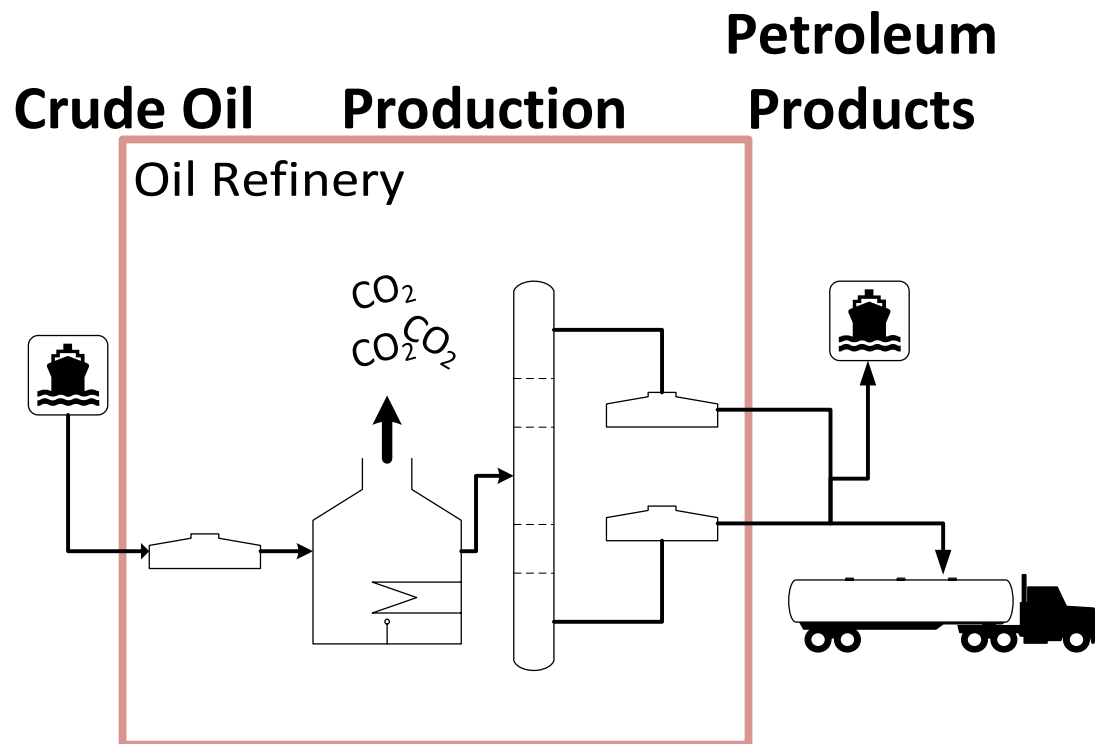
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# Heat recovery potentials in industrial processes



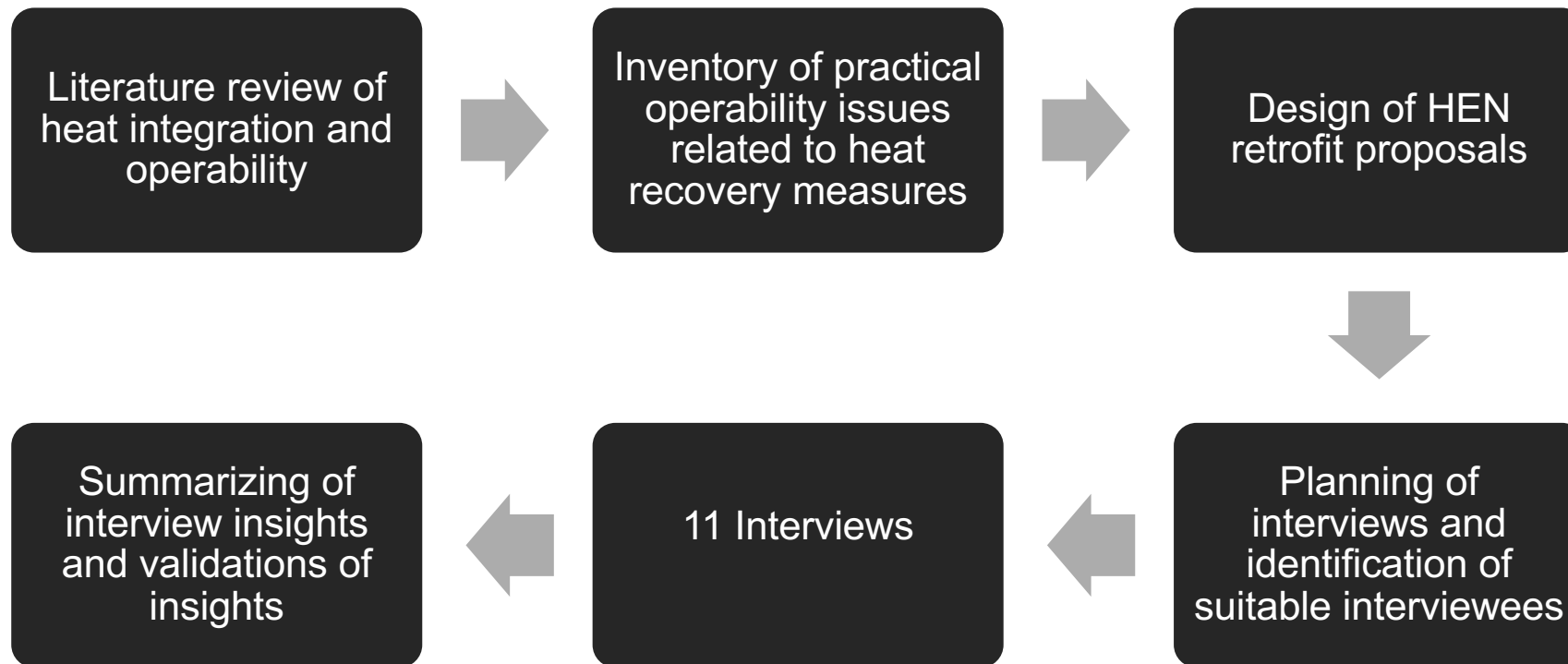
# Oil refinery – case study



⚙ **Crude oil:**  
**11.4 Mton/year**

⚙ **CO<sub>2</sub> emissions:**  
**1.7 Mton/year**

# Work flow interview study

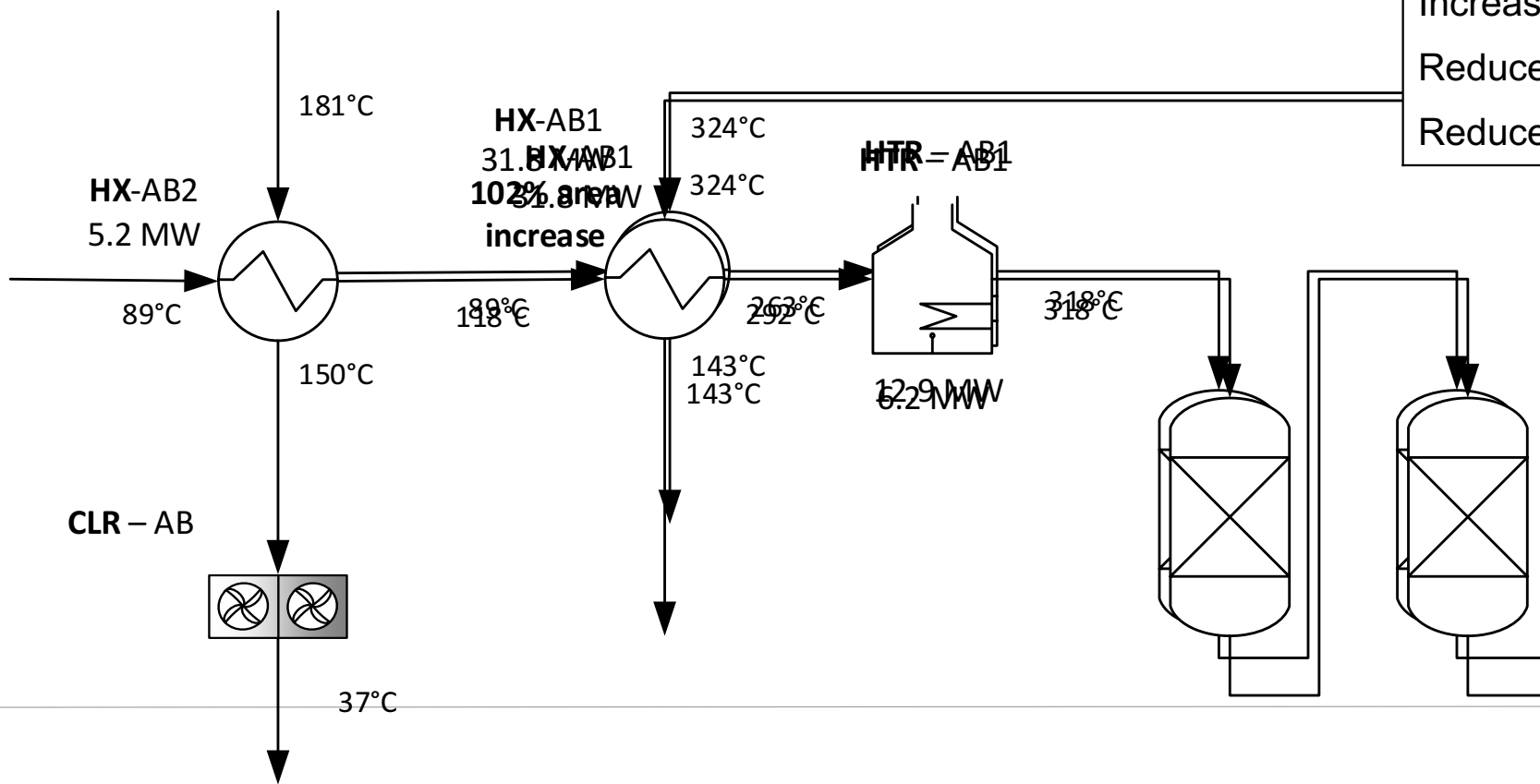


# Main results

- ✧ Practical issues in most retrofit proposals – solutions are usually possible
  - ✧ Non-energy benefits important
    - ✧ De-bottlenecking
    - ✧ Increased yield of desirable products
    - ✧ Decreased load on limiting air coolers
    - ✧ A simultaneous energy saving can motivate replacing existing heat exchangers with operating problems
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# Example

## Heat exchanger network retrofit proposal



# Example

Main potential issues and benefits for the retrofit proposal

## Potential issues

Decreased flexibility and controllability from heat exchange between process units

Spatial limitations → current HX must be replaced to provide space

Time limitations during rebuilds

Increased pressure drop

## Benefits

Fuel gas savings from reduced furnace load

Production increase

Decreased CO<sub>2</sub> emissions

Reduced load on limiting air cooler

Increased flexibility from reduced load on heater and cooler

# Example

Monetary values of non-energy benefits

	<b>Investment cost</b>	<b>Energy cost savings</b>	<b>Reduced CO<sub>2</sub> emissions cost</b>	<b>Annual revenues from production increase</b>	<b>Annual cash flow</b>	<b>Pay back period</b>
Retrofit proposal without NEBs	2.66 M€	1.54 M€/year	--	--	1.54 M€/year	1.72 years



# Thank you for listening!

**Questions for discussion:** Do we start at the wrong end when designing energy system modifications? Should non-energy benefits and process issues be included at an earlier stage?