



Energia e Sustentabilidade

A Eficiência Energética na Indústria

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CERENA / Chemical Eng. Department / IST/ ULisboa

Instrumentos Legislativos em PT

Diploma: Decreto-Lei n.º 71/2008, de 2008-04-15

Sumário: Estabelece o [sistema de gestão do consumo de energia](#) por empresas e instalações consumidoras intensivas e revoga os Decretos-Leis n.os 58/82, de 26 de Novembro, e 428/83, de 9 de Dezembro



Diploma: Resolução do Conselho de Ministros n.º 80/2008, de 2008-05-20

Sumário: Aprova o Plano Nacional de Acção para a Eficiência Energética (2008-2015)

Diploma: Resolução do Conselho de Ministros n.º 20/2013, de 2013-04-10

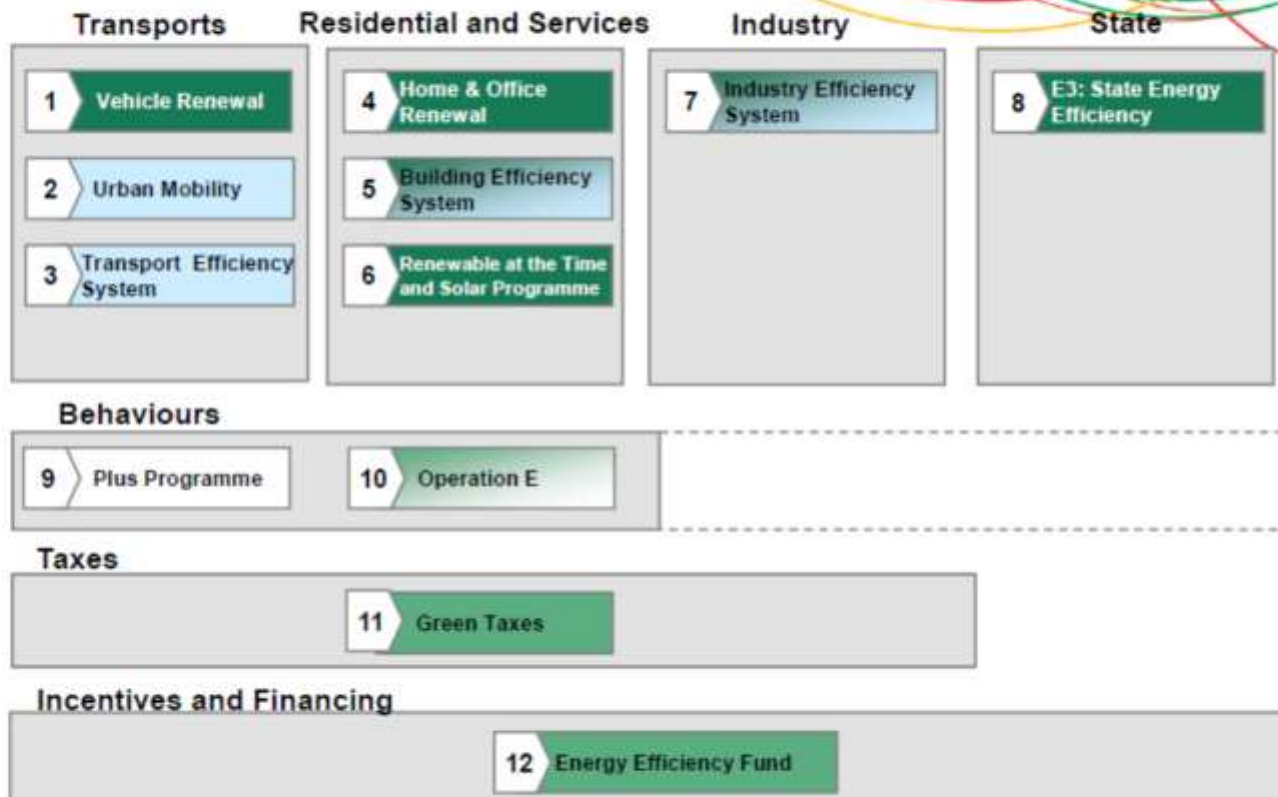
Sumário: Aprova o [Plano Nacional de Acção para a Eficiência Energética](#) para o período 2013-2016 e o Plano Nacional de Acção para as Energias Renováveis para o período 2013-2020.

Diploma: Decreto-Lei n.º 68-A/2015, de 30 de abril

Súmário: Estabelece disposições em matéria de eficiência energética e cogeração, transpondo para a ordem jurídica interna a Diretiva n.º 2012/27/UE, do Parlamento Europeu e do Conselho, de 25 de outubro de 2012, relativa à eficiência energética.

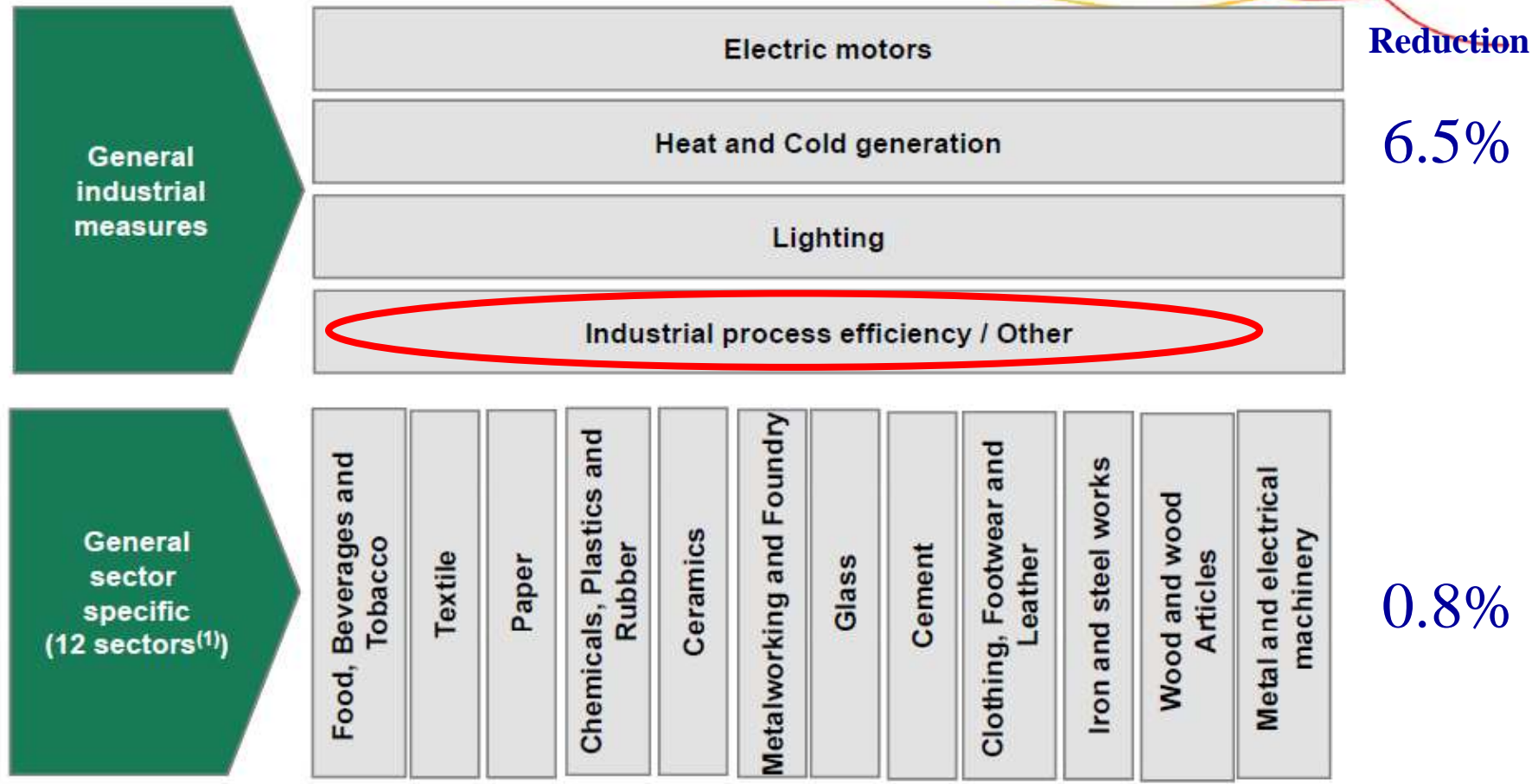
12 great Portugal Efficiency 2015 Programmes

Focussing on different ways to promote energy efficiency



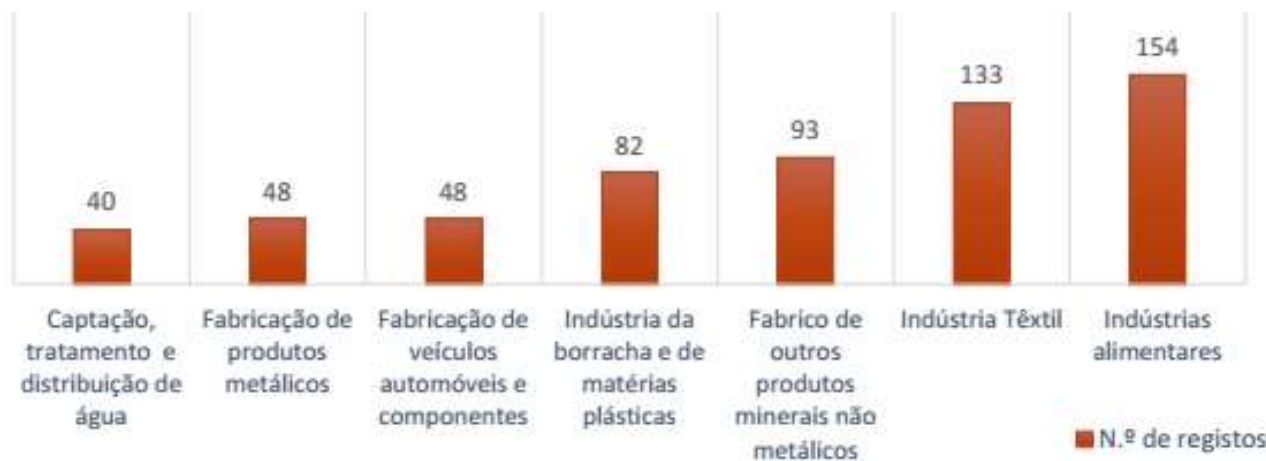
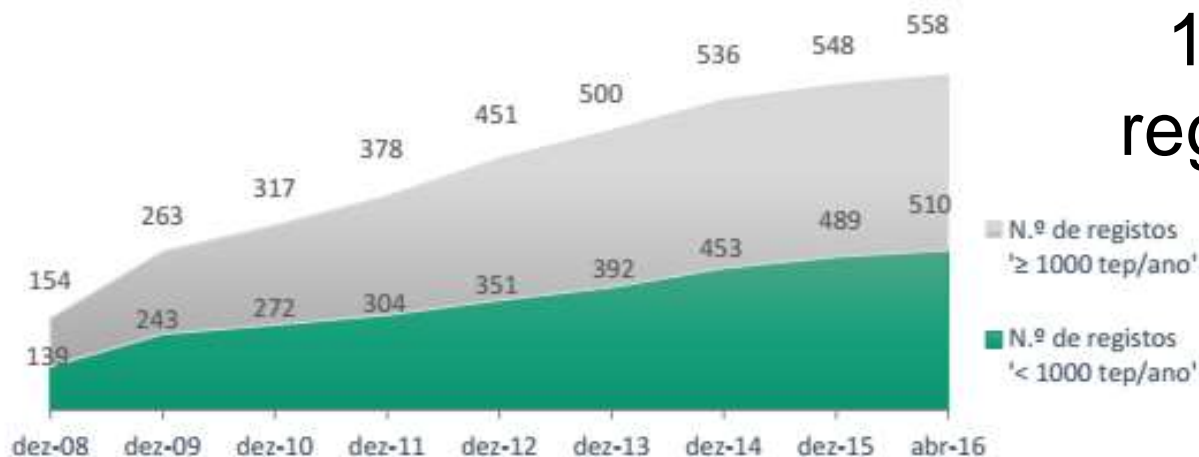
- The political and technological measures to increase EE in Portuguese Industry ("Program 7") should follow the **recommendations and general guidelines** from EU and should follow the already implemented successful examples in some **Reference Countries!**.

Improvement measures are classed as general industrial and sector-specific

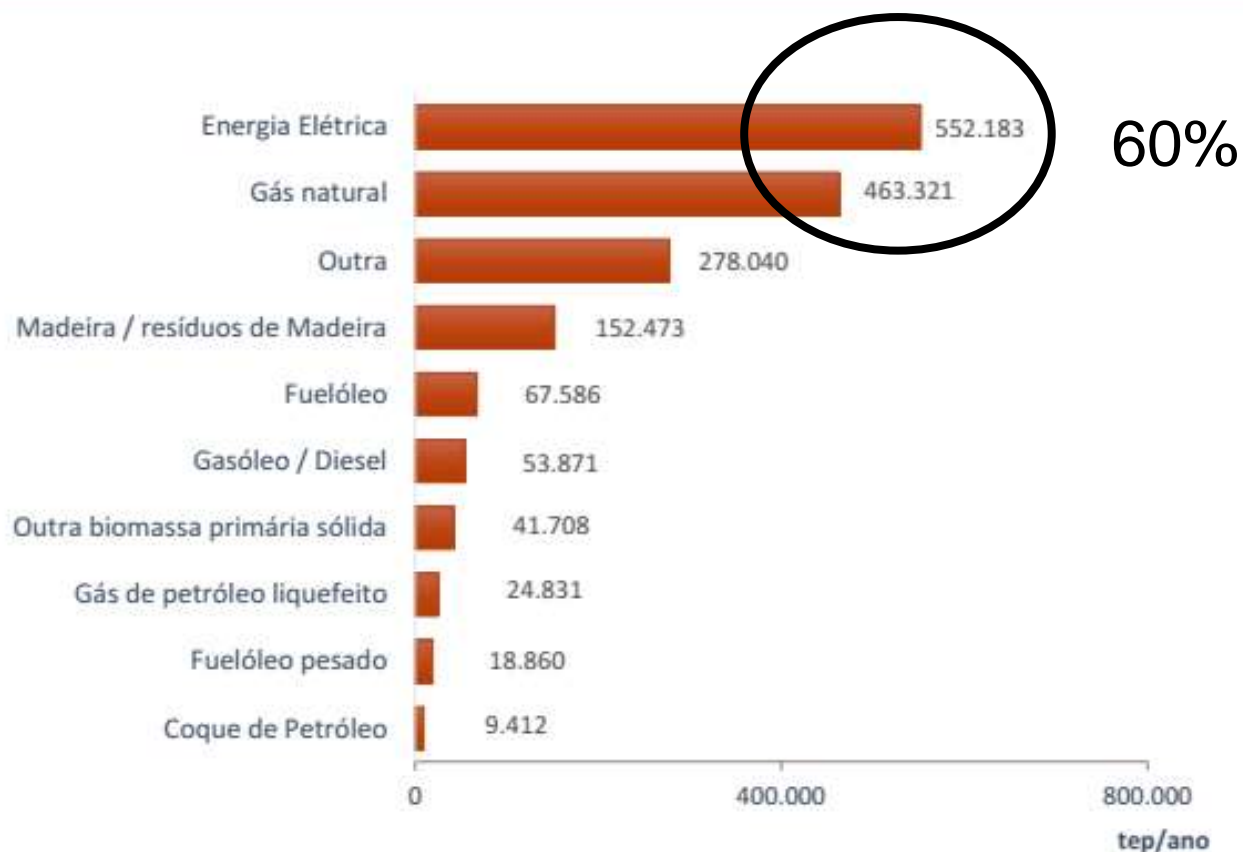


Registo de Instalações

1068 registos



Registo de Instalações



Planos de Racionalização do Consumo de Energia - Medidas Transversais

	Potencial de redução Global (tep/ano)	PRI (anos)	Custo de redução por tep (€/tep)	Redução GEE (t CO ₂ e)	Potencial de redução por instalação (tep/ano)
Formação e sensibilização de recursos humanos	1.973	,30	210	7.776	12,57
Frio Industrial	2.147	4,27	4.231	11.571	18,35
Iluminação eficiente	7.366	3,33	3.746	40.249	10,26
Integração de processos ★	5.249	,93	374	14.736	262,43
Isolamentos térmicos ★	9.020	1,24	548	24.804	24,31
Manutenção de equipamentos consumidores de energia	1.575	2,98	1.948	5.687	11,50
Monitorização e controlo	7.336	1,60	1.242	31.650	19,88
Optimização de motores	4.847	2,36	2.350	26.297	14,09
Outros ★	14.252	3,90	2.426	45.711	38,94
Recuperação de calor ★	23.765	2,0	773	62.670	81,95
Sistemas de bombagem	2.380	1,98	2.026	13.004	14,87
Sistemas de combustão ★	11.202	2,16	1.522	43.956	38,36
Sistemas de compressão	6.798	2,20	2.256	36.922	11,72
Sistemas de ventilação	2.545	1,51	1.474	13.360	12,92
Transportes	534	3,69	4.298	1.611	19,08
Tratamento de efluentes ★	887	1,28	626	2.637	73,95
Total Geral	101.875	2,40	1.613	382.642	-



What is Process Integration (Pinch Analysis) ?

- Methodology that allows to identify process alternatives leading to the **minimisation of primary energy consumption** and fresh water.
- In **Heat Integration** it is intended to **maximise the energy exchanges between process streams** so that the consumption of external utilities (hot and/or cold) is minimised.

When and where it applies?

- One can apply it in the Project phase (*Grassroot*) or in reconversion (*Retrofit*)
- In industrial units of large or small scale, in continuous or discontinuous regime
- It is applied to several industrial sectors such as Petrochemical, paper and pulp, textile and also in services such as hospitals, shopping centres, *etc.*

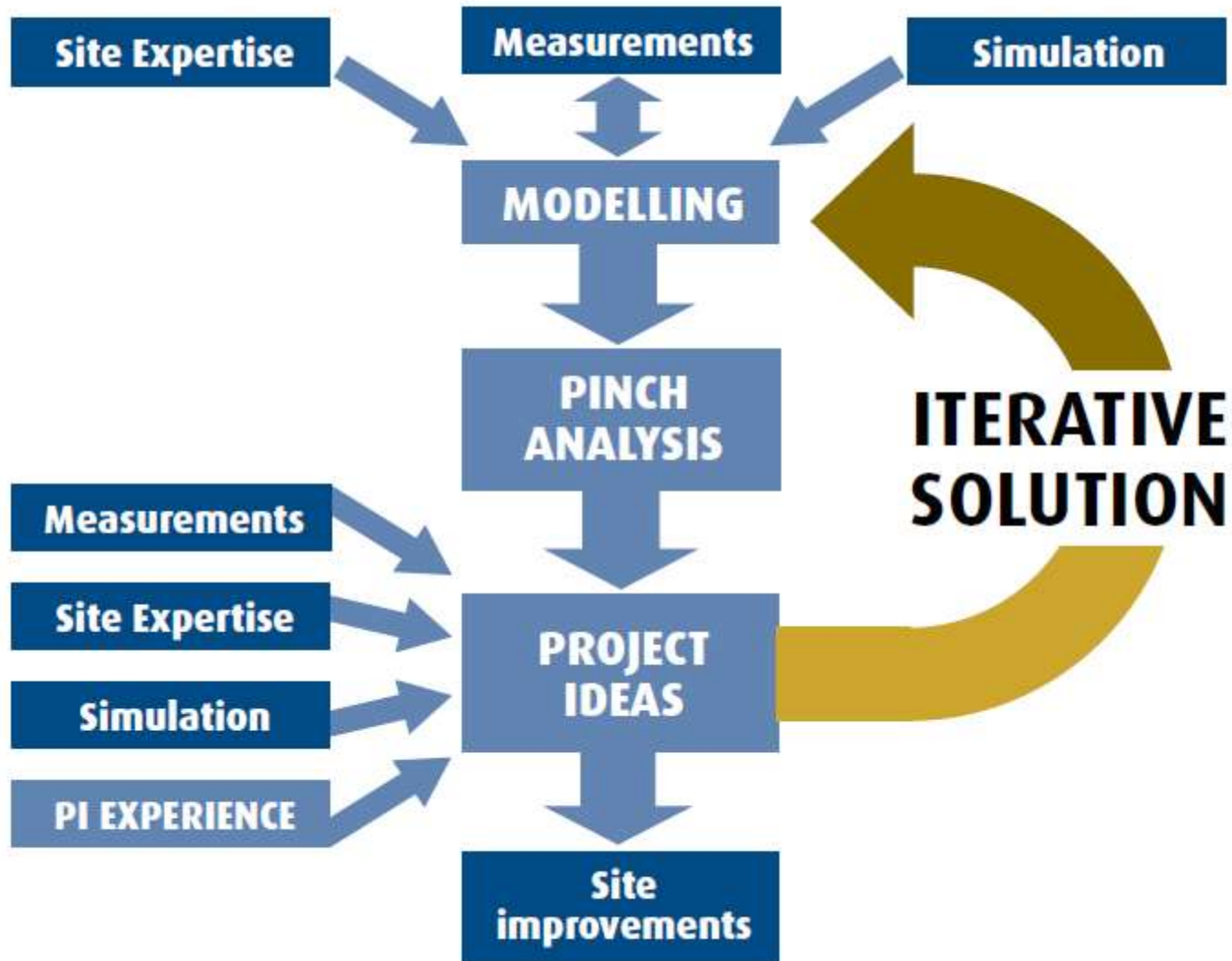
Advantages of Process Heat Integration (PHI)

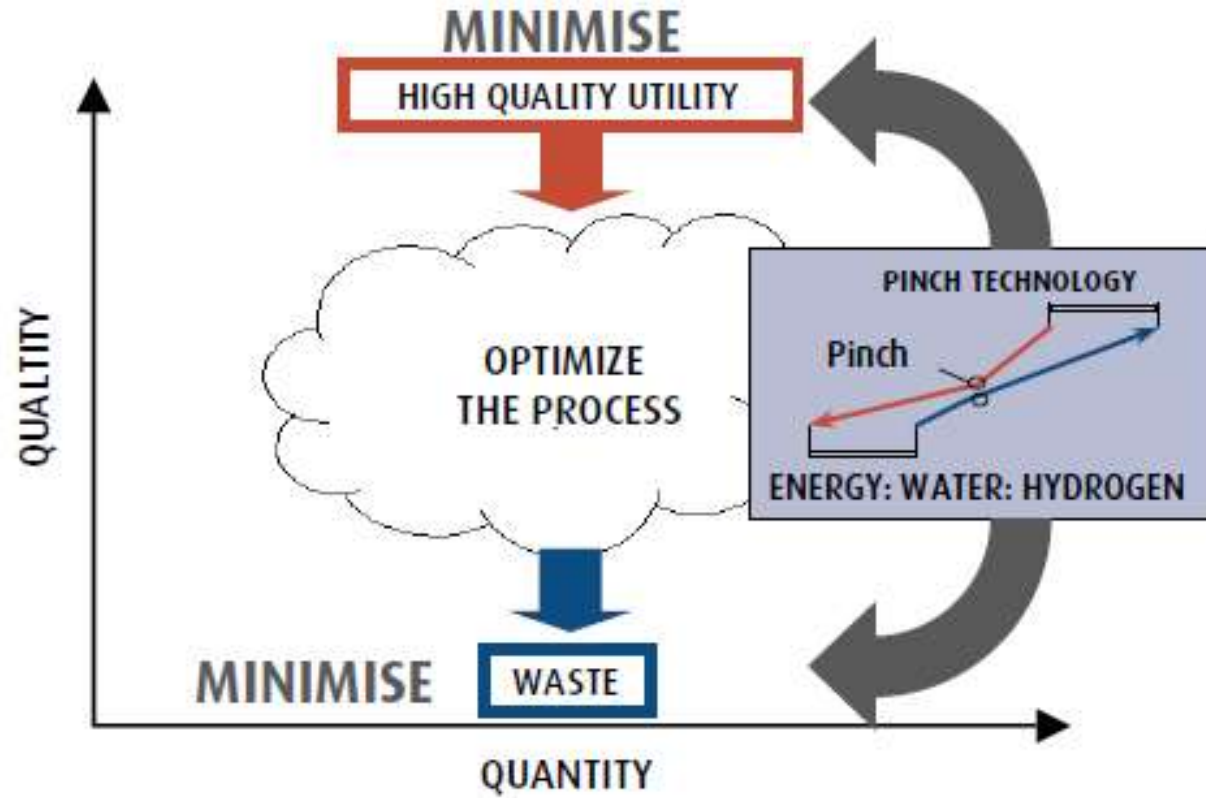
- Typical reduction of energy: 15-45%
- Low payback times: 16 months
- Contribution for reduction of CO₂ emissions
- Improvement in energy and environmental efficiency, through a most appropriate recirculation of by-products and effluents;

Disadvantages in PHI application

- The application of PI projects is a function of investment and payback time and not of the opportunity/technical feasibility of the improvement.
- Hard to implement in industries operating already.

Strategy to apply Pinch Analysis





Some Base Concepts

Cold Stream:

- Process stream which temperature needs to be raised and/or where occurs a change in state due to heat absorption.

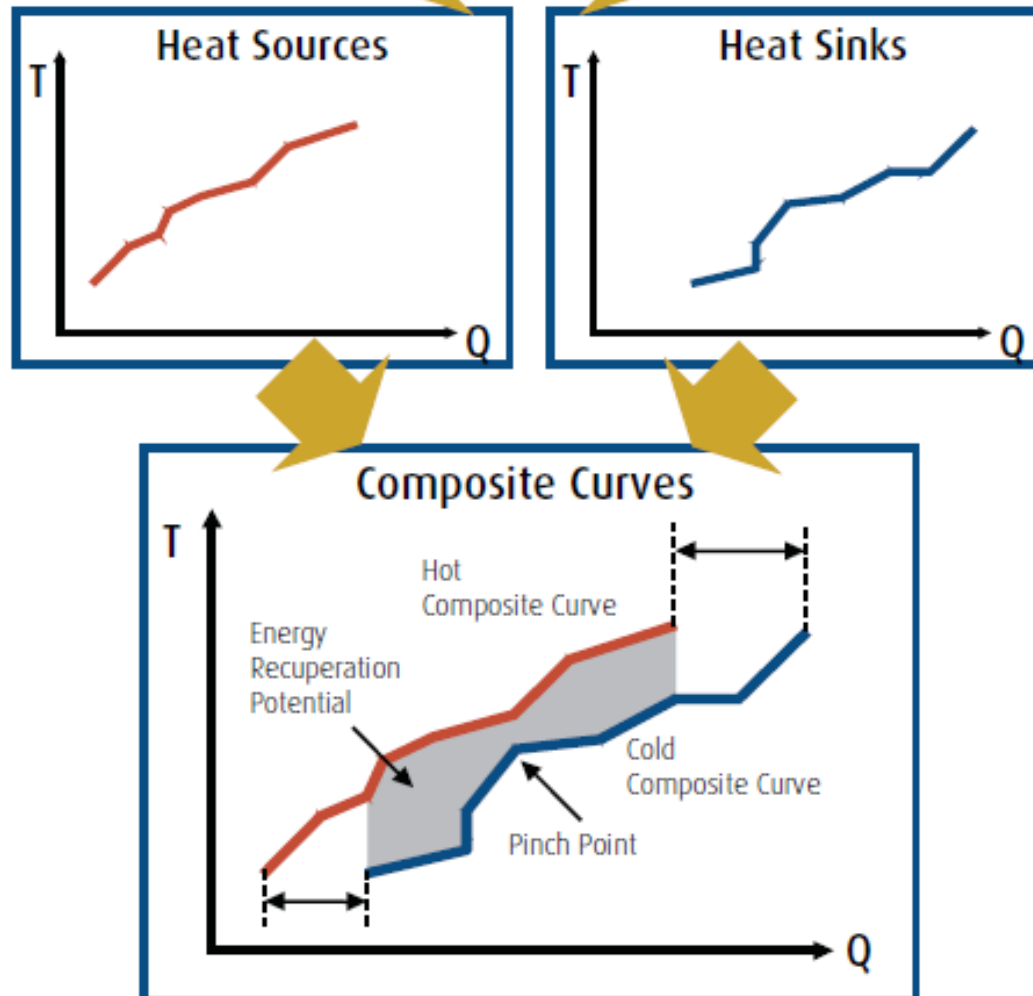
Hot stream:

- Process stream which temperature needs to be decreased and/or where occurs a change in state due to heat release.

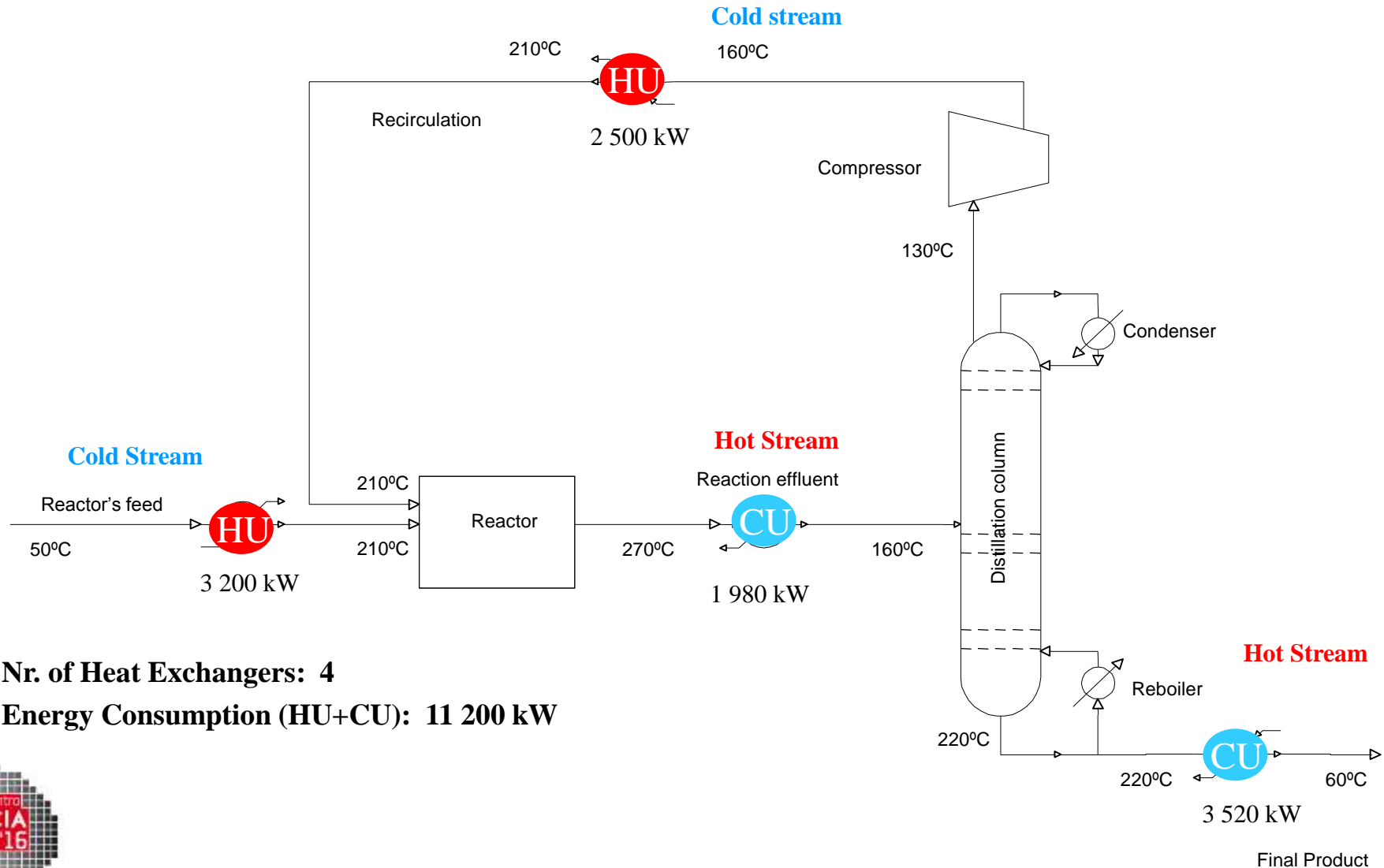
External Utilities:

- External fluids to the process that exchange directly with the process streams in order to supply or remove them enthalpy. They can be **hot** (water steam, hot fluids, gaseous effluents, flue gases, etc.) or **cold** (refrigerating water, atmospheric air, or other type of cooling fluid).

PROCESS STREAM DATA



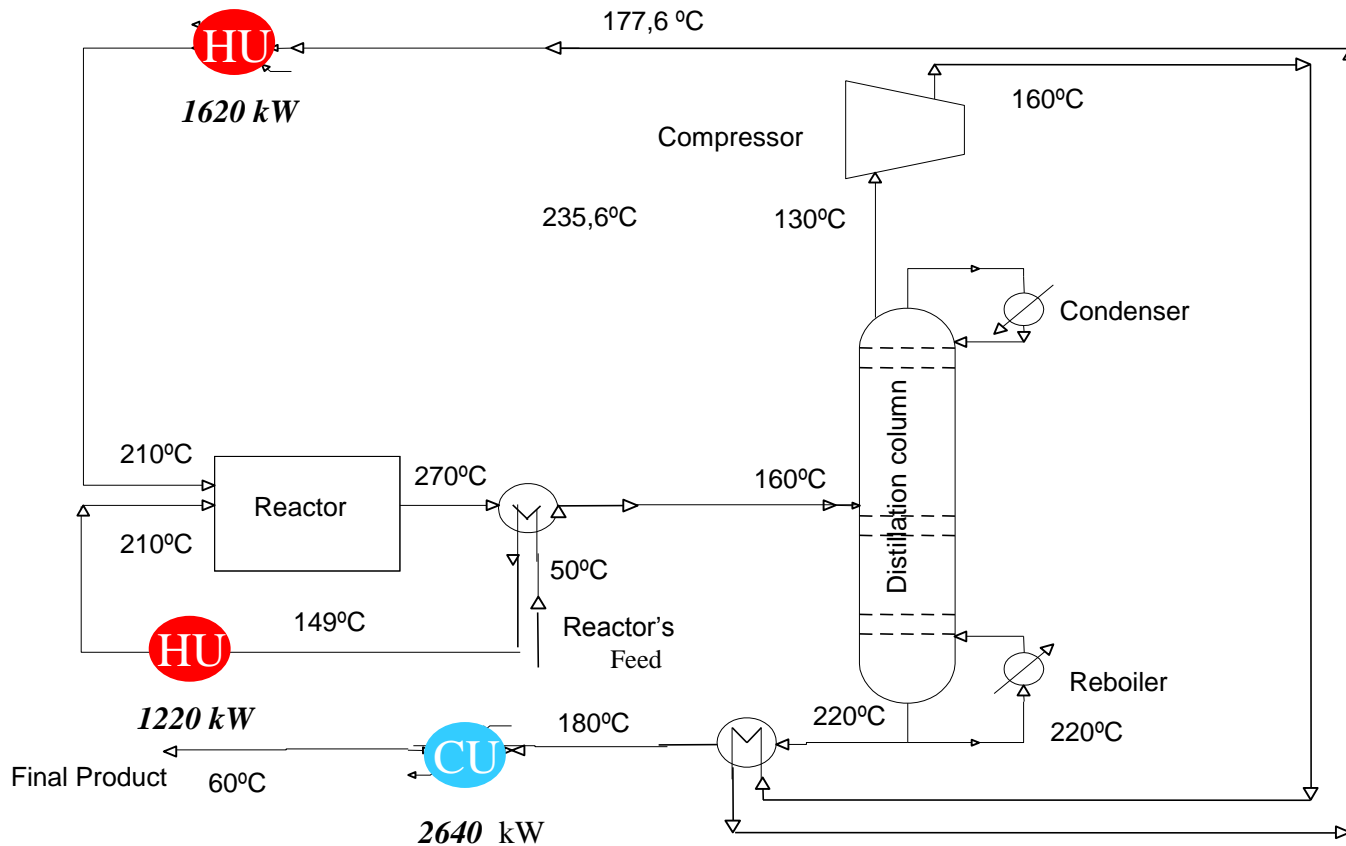
Example 1 (without Process Integration):



Nr. of Heat Exchangers: 4

Energy Consumption (HU+CU): 11 200 kW

Example 1 with Empirical integration:

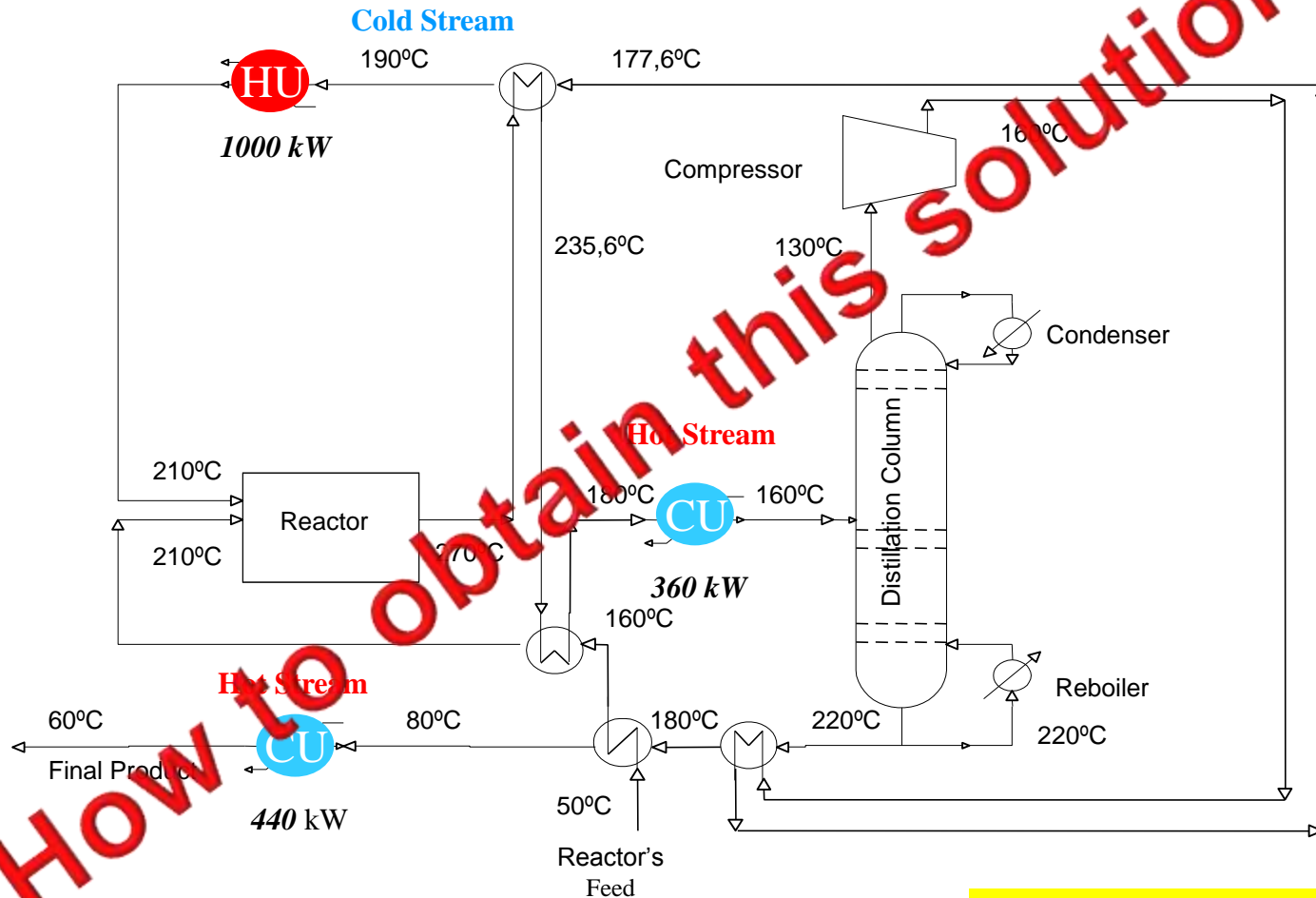


Energy Reduction: ~ 51%

Nr. of Heat Exchangers: 5

Energy Consumption (HU+CU): 5480 kW (HU=2840 kW e CU = 2640 kW)

Example 1 after application of Process Integration (Pinch Analysis):



How to obtain this solution?

Energy Reduction : ~ 84%

Total Cost Reduction: ~ 60%

Heat Exchangers: 7
 Energy Consumption (HU+CU): 1800 kW

FREE Software used to solve practical cases

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Tool in the scope of

Operational Management

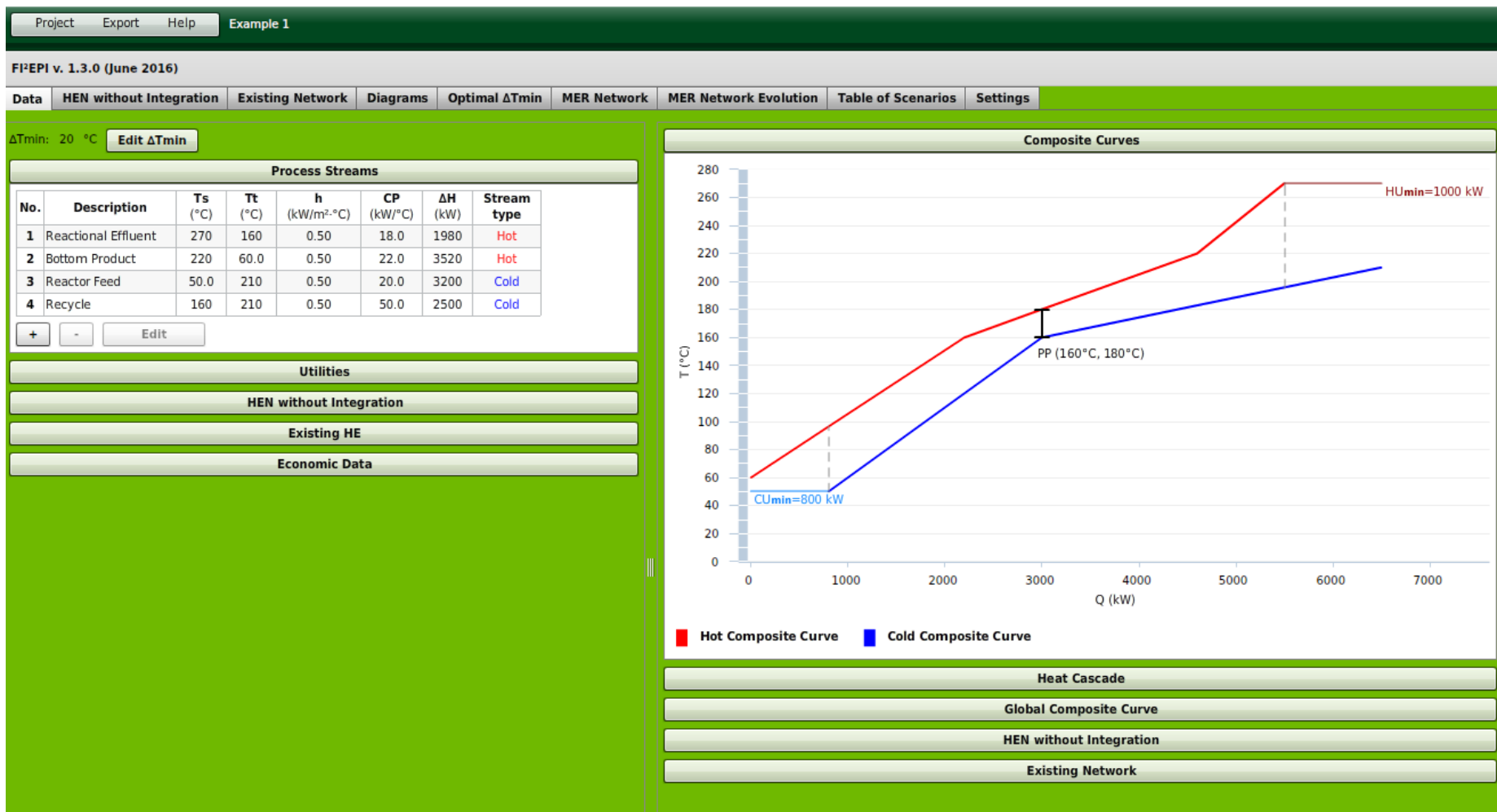
Control and Supervision

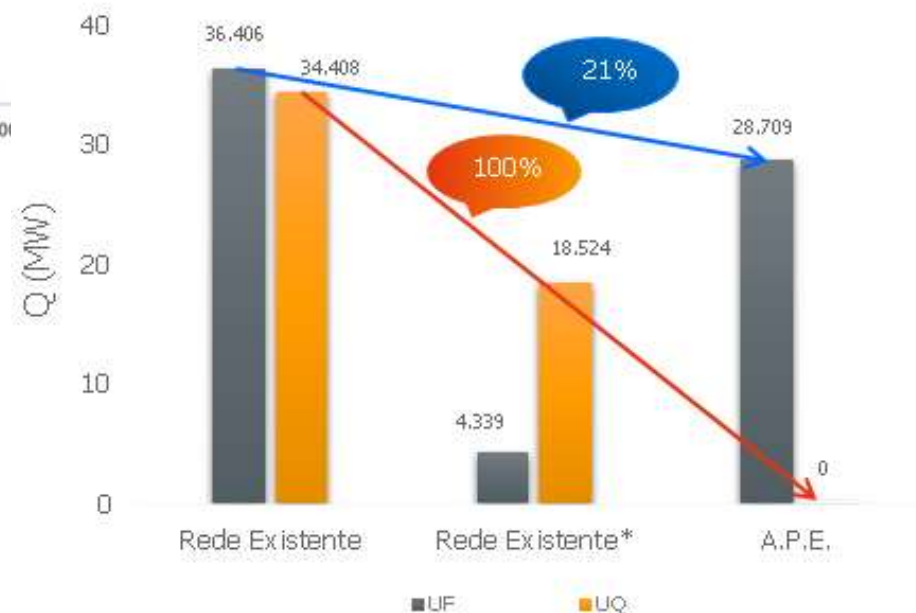
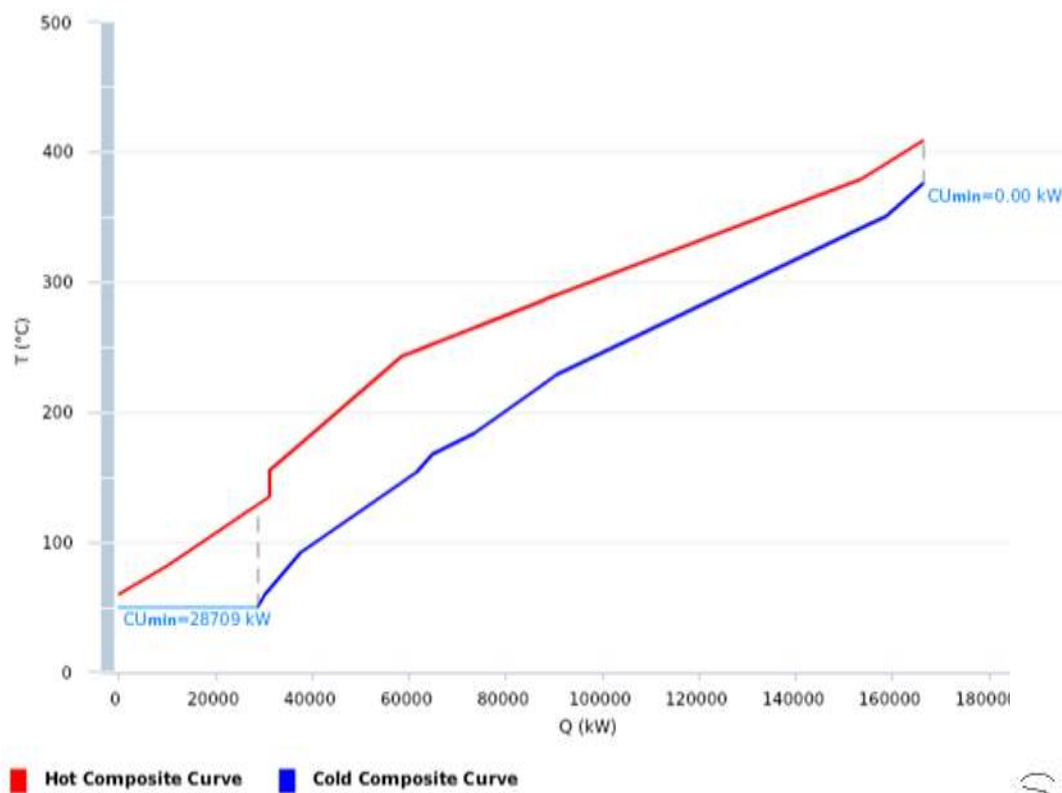
sgcie SISTEMA DE GESTÃO DOS CONSULTORES INDUSTRIAIS DE ENERGIA

ADENE AGÊNCIA PARA A ENERGIA

Direção Geral de Energia e Geologia







Notas Finais

- Instrumentos legislativos exigem a análise dos Processos Industriais e obrigam aos PRE's
- Há um crescente número de consumo intensivo a aderirem ao SGCIE
- A metodologia de Integração Energética tem uma abordagem holística
- FI²EPI é uma ferramenta disponível para executar a Análise de Ponto de Estrangulamento
- Num exemplo industrial obtêm-se uma redução de 100% em UQ e 21% em UF