



SHIP Egypt

Session 01

Project introduction and starting point

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Overview

- **Training agenda**
- **Introduction of the project**
- **Starting point**
- **Industrial energy demand**
- **SHIP potential**

Training agenda – day 1

Day 1				
Start	End	Content	Comments	
08:30	09:00	Registration	-	
09:00	10:30	Introduction and welcome	-	
		Get together	Individual introduction	
		Presentation on UNIDO project	Slides module 01	
		Training agenda	Slides module 01	
10:30	11:00	Tea / Coffee break for interactive discussion		
11:00	12:30	Presentation on energy assessment and energy audit (ISO 50002, EN 16247, EINSTEIN)	Slides module 03	
		Interactive group work on energy audit	Group work	
12:30	14:00	Lunch break		
14:00	15:30	Presentation on thermodynamic basics	Slides module 02	
		Presentation: Typical energy consuming processes of relevant industry sectors	Slides module 05	
		Group work on flow sheet of relevant industry sectors	Group work	
15:30	16:00	Tea / Coffee break for interactive discussion		
16:00	17:30	Presentation of flow sheets of relevant industry sectors	Presentation by participants	
		Presentation of test case	Test Case	
		Development of flow sheet of test case	Group work and presentation supported by trainers	
17:30	Closure day 1			

Training agenda – day 2

Day 2			
Start	End	Content	Comments
09:00	10:30	Day opening	
		Wrap up of Day 1 (Energy audit, Test case flow sheet)	Participant question
		Calculation of mass and energy balance (test case)	Participants supported by trainers
10:30	11:00	Tea / Coffee break for interactive discussion	
11:00	12:30	Discussion of mass and energy balance (test case)	Flip chart calculation by trainer
		Presentation on compressed air	Slide module 10
12:30	14:00	Lunch break	
14:00	15:30	Presentation on heat supply	Slide module 08
		Mass and energy balance, measurement plan and audit steps for company cases	Participants supported by trainers
15:30	16:00	Tea / Coffee break for interactive discussion	
16:00	17:00	Presentation on cold supply	Slide module 09
		Presentation on mass and energy balance, measurement plan and audit steps for company cases	Group work and presentation supported by trainers
17:00	17:30	Intermediate feedback round	
17:30		Closure day 2	

Training agenda – day 3

Day 3			
Start	End	Content	Comments
09:00	10:30	Day opening Wrap up of Day 2 Sankey charts of test case with tools	Participant question Participants supported by trainers, Sankey tool
10:30	11:00	Tea / Coffee break for interactive discussion	
11:00	12:30	Presentation on process optimisation Discussion on process optimisation in test case Group work on process optimisation in company cases	Slide module 12 Discussion Group work and presentation supported by trainers
12:30	14:00	Lunch break	
14:00	15:30	Presentation on basics of heat transfer Presentation on types of heat exchangers	Slide module 13 (Part I)
15:30	16:00	Tea / Coffee break for interactive discussion	
16:00	17:30	Presentation on heat integration focus Pinch analyses Group work on system optimisation in company cases Discussion on heat integration linked to experience in companies and best practice examples	Slide module 13 (Part II) Group work
17:30	Closure day 3		

Training agenda – day 4

Day 4			
Start	End	Content	Comments
09:00	10:30	Day opening Wrap up of Day 3 Application of Pinch analyses in test case	Participant question Group work, Pinch tool, discussion and presentation supported by trainers
10:30	11:00	Tea / Coffee break for interactive discussion	
11:00	12:30	Presentation of evaluation criteria on feasibility of measures	Slide module 16
12:30	14:00	Lunch break	
14:00	15:30	Discussion on evaluation of identified measures of process optimisation and heat recovery in test case Training evaluation	Group work and presentation supported by trainers
15:30	16:00	Tea / Coffee break for interactive discussion	
16:00	17:00	Closing session Outlook and next steps	
17:00	17:30	Discussion and Feedback round	
17:30		Training closure	



Introduction round

Participants Introduction

- **Name**
- **Background**
 - ⇒ Work experience
 - ⇒ Education
- **Experience with ISO**
- **Experience with Energy**
- **Expectations**
- **Personal Goal for the course**

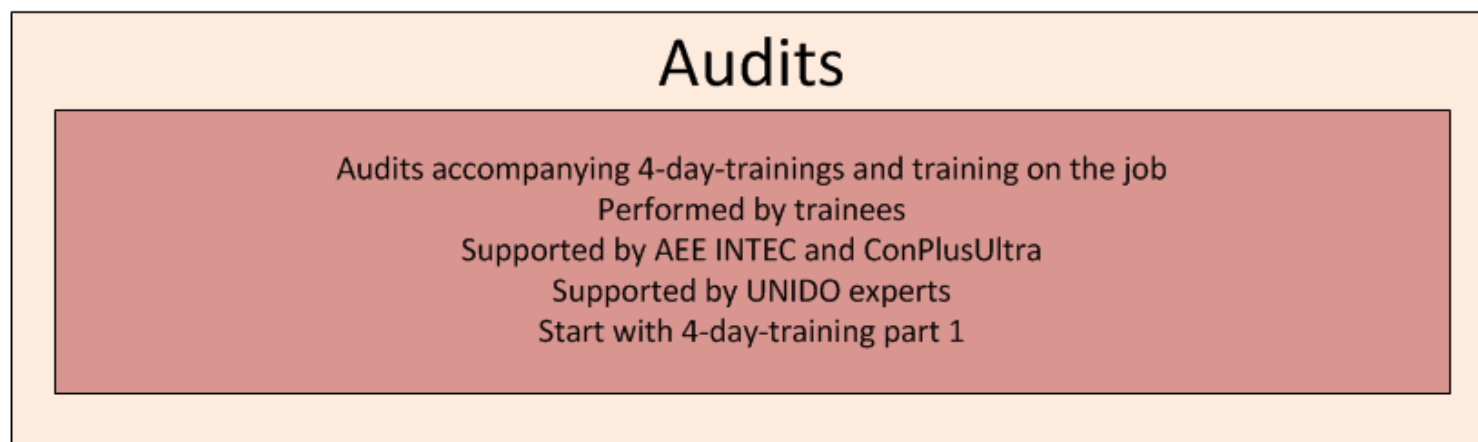
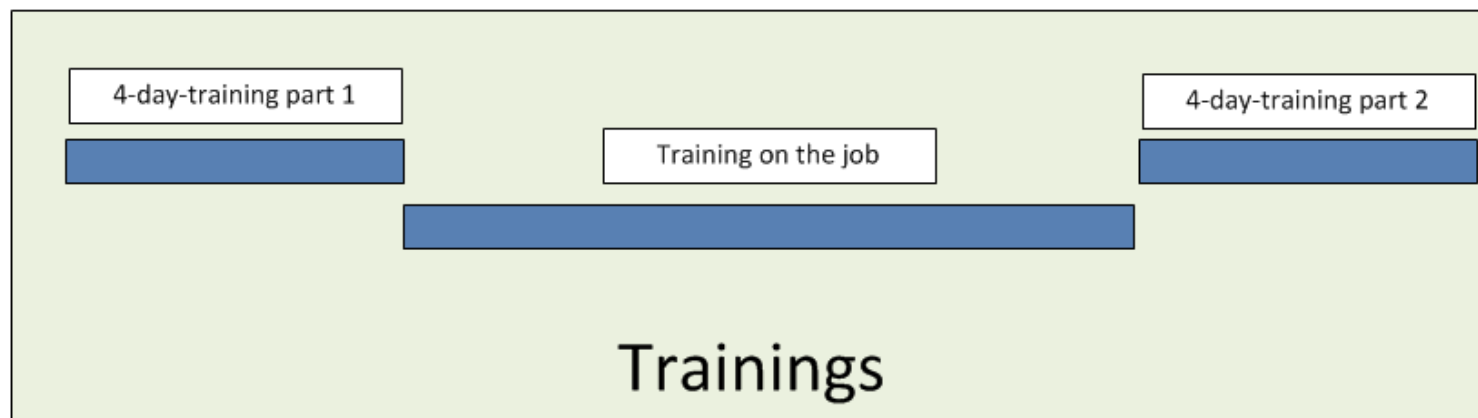
Project introduction

Background Information

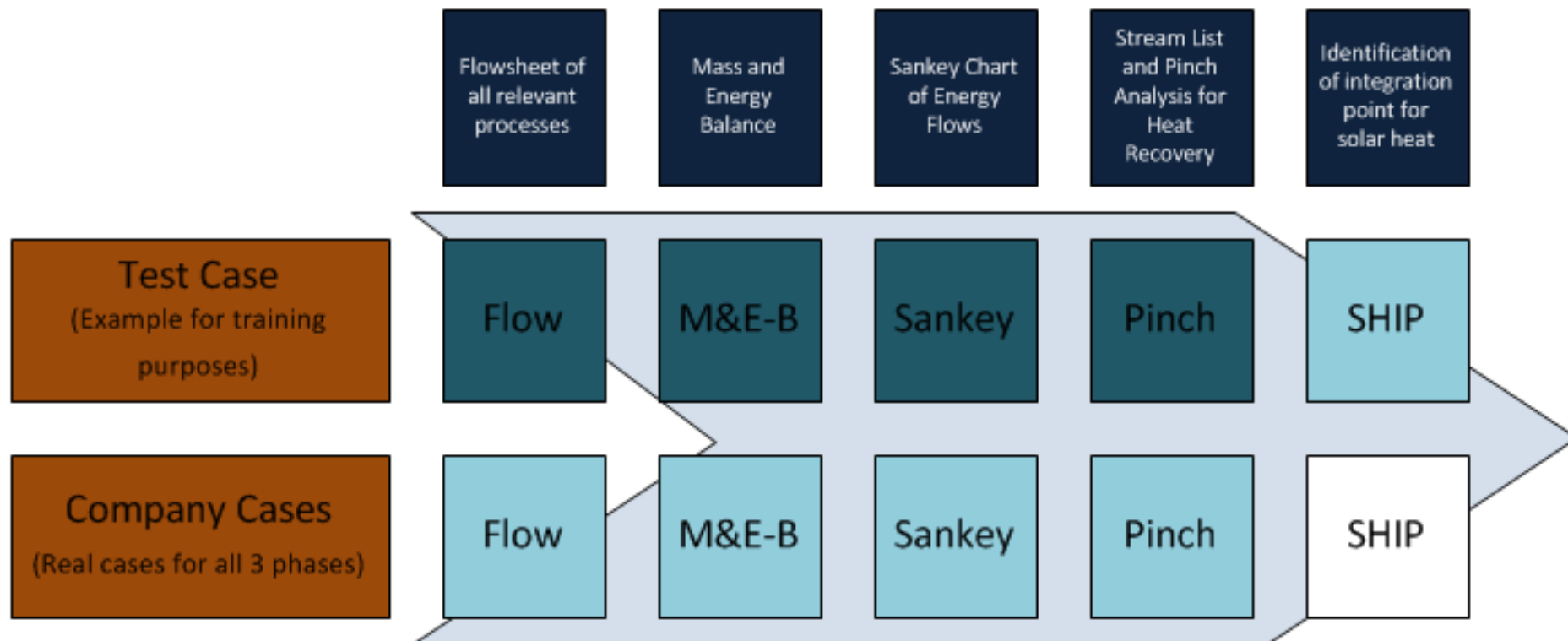
- **UNIDO GEF project
„Utilizing Solar Energy for Industrial Process
Heat in Egyptian Industry“**

- **5 Outcomes**
 - ⇒ Policy instruments for promoting SHIP in 3 sectors
 - ⇒ Financing of SHIP mobilized
 - ⇒ Market of solar energy components and systems strenghtended
 - ⇒ **Technicial capacity of the system designers, developers, facility managers and service providers for solar energy utilization for industrial process heat enhanced**
 - ⇒ Monitoring and evaluation mechanisms in place

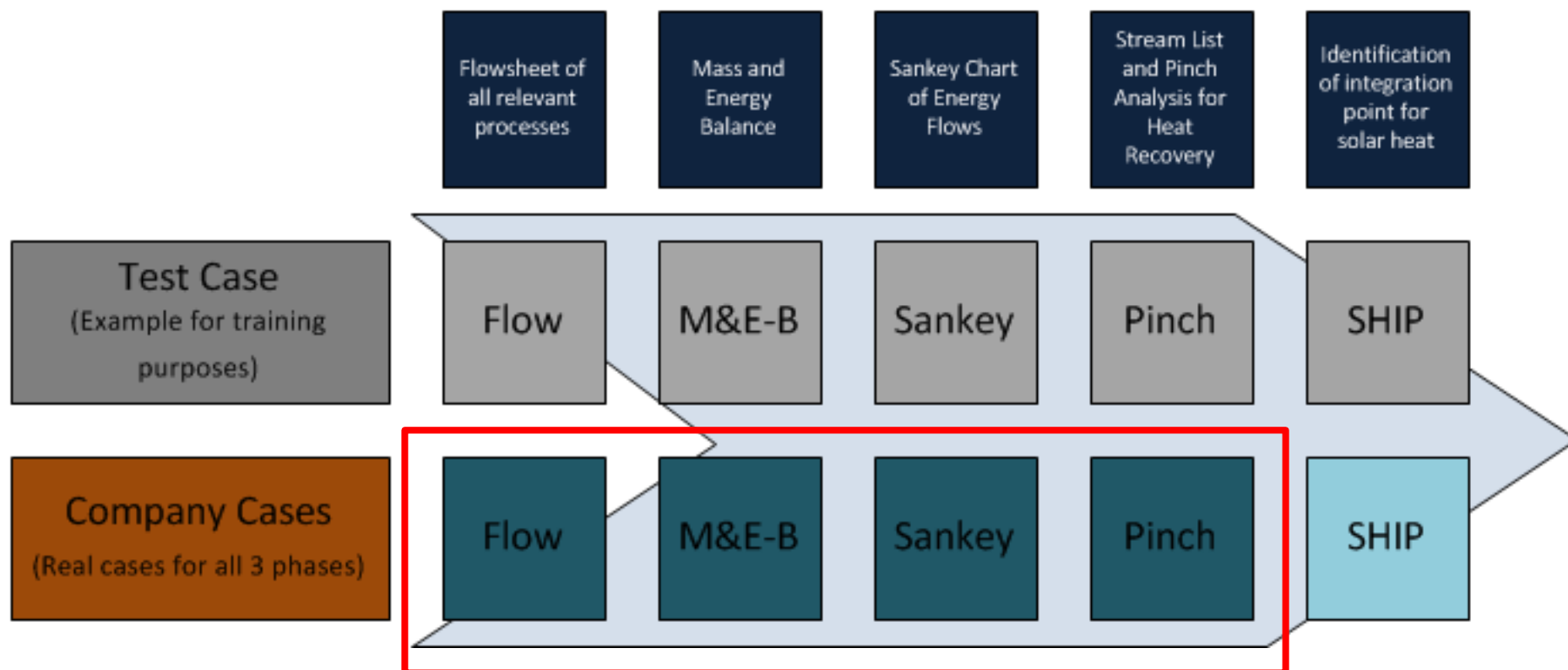
Timeline



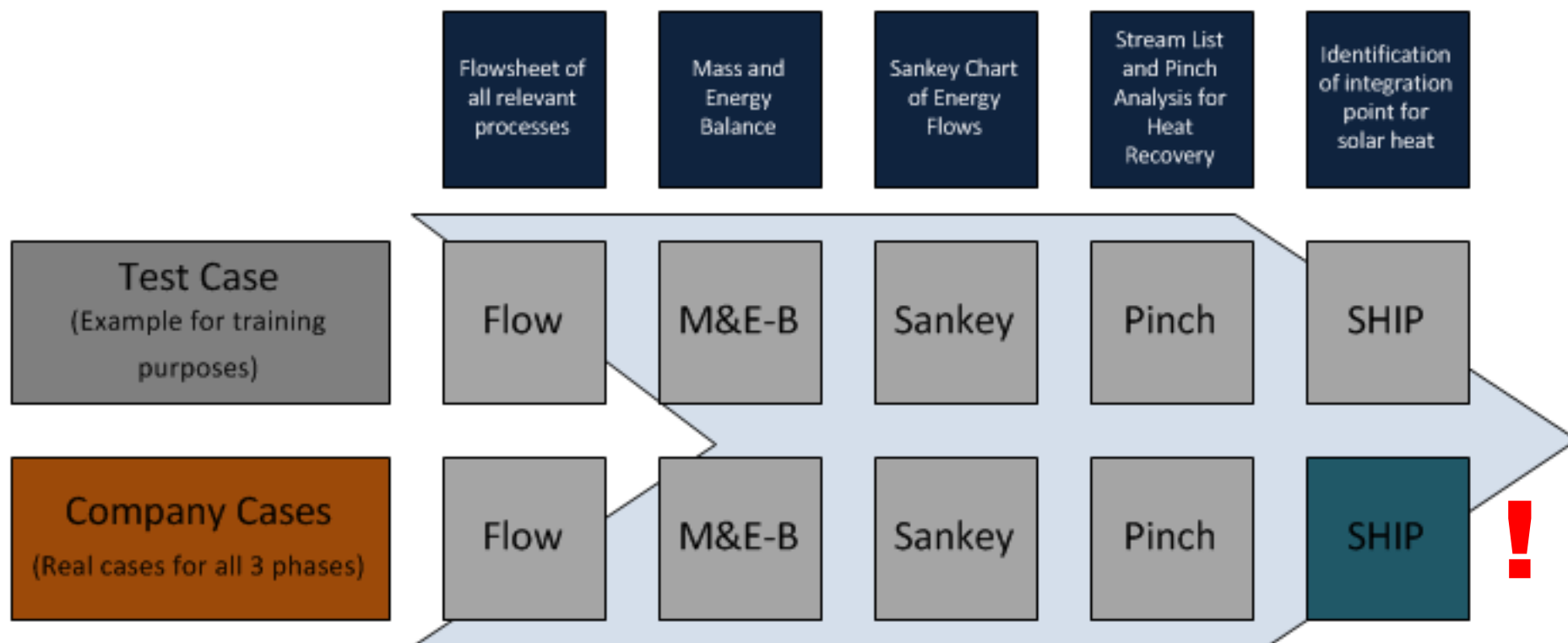
Objectives Phase I



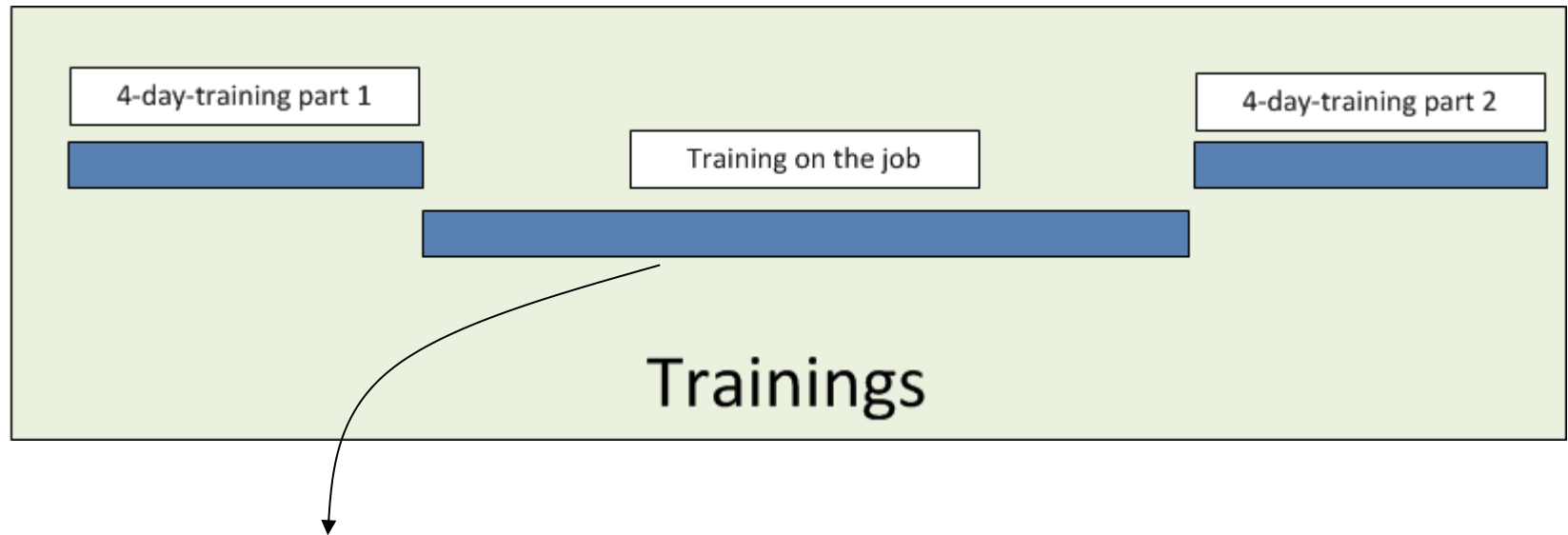
Objectives Phase II



Objectives Phase III



Relevant industry sectors



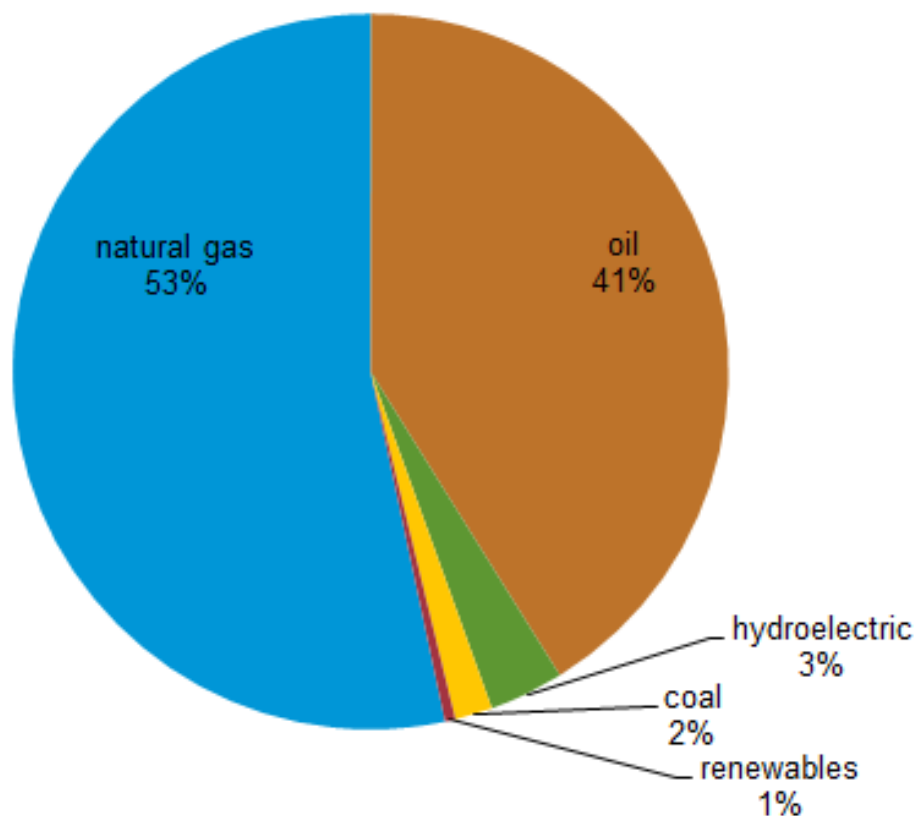
➤ **3 sectors in focus**

- ⇒ Food
- ⇒ Textile
- ⇒ Chemical

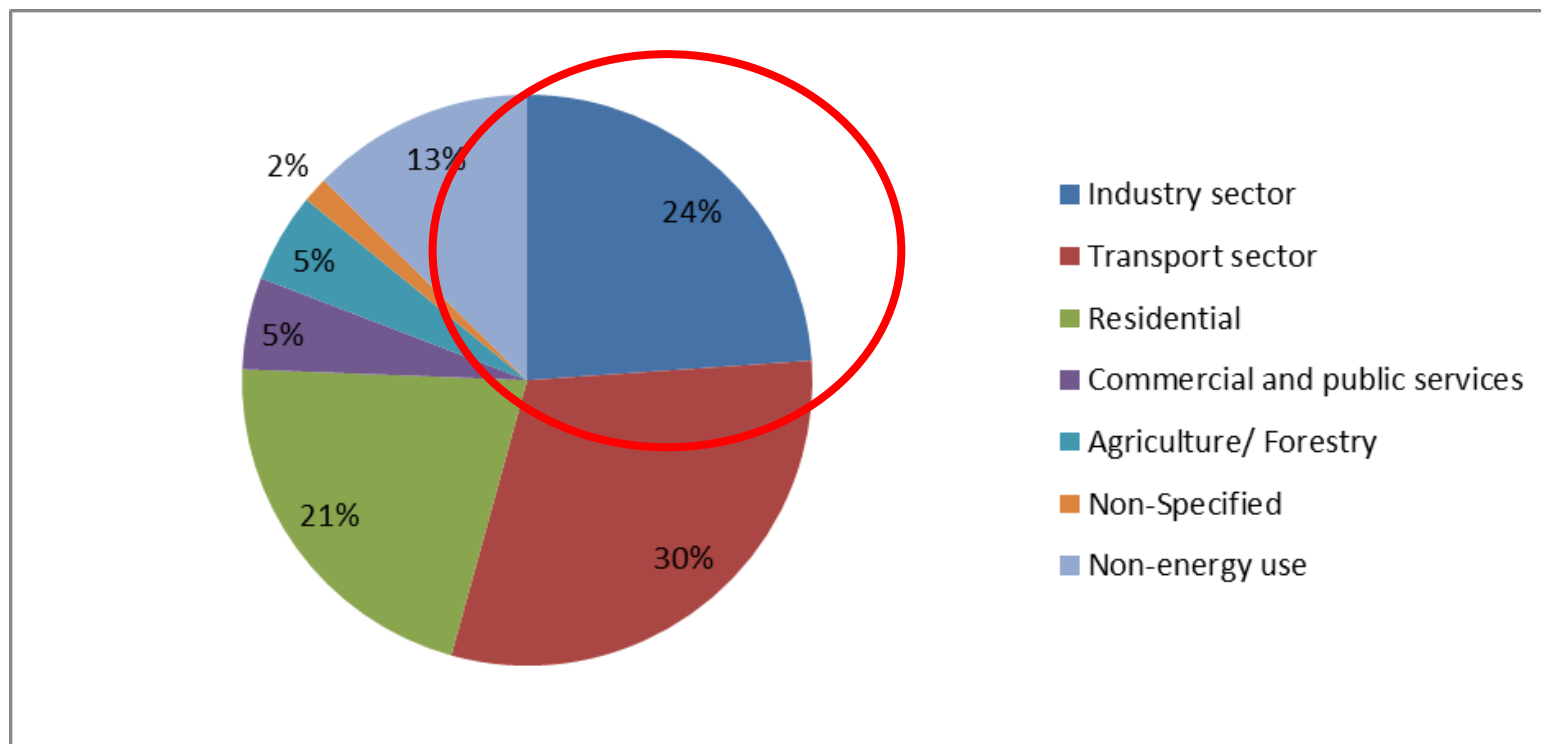
Starting point – SHIP Egypt

Energy demand in Egypt

➤ Primary energy consumption in Egypt 2013

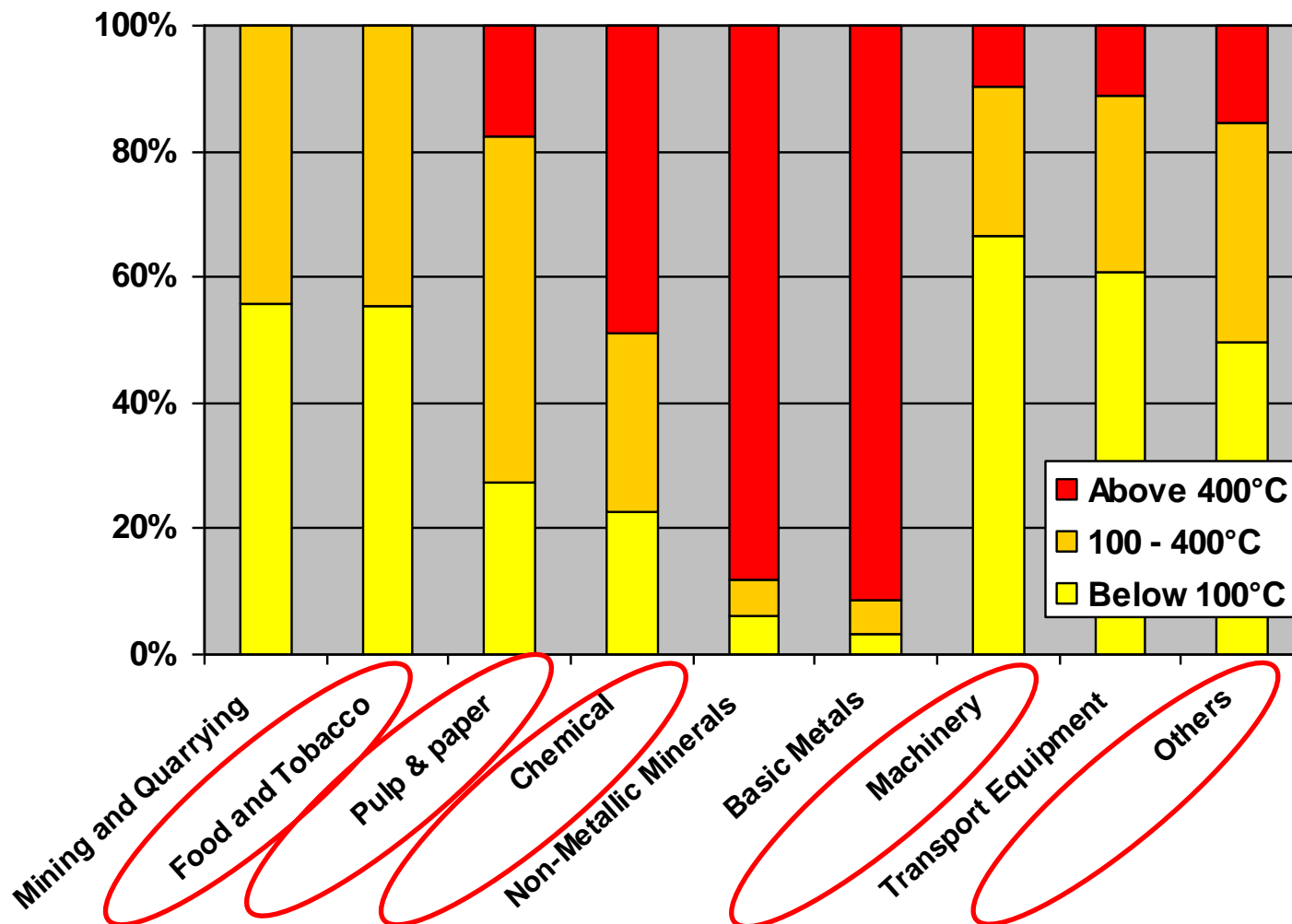


Final energy consumption Egypt



Source: IEA (2014)

Temperature Levels in Different Industries

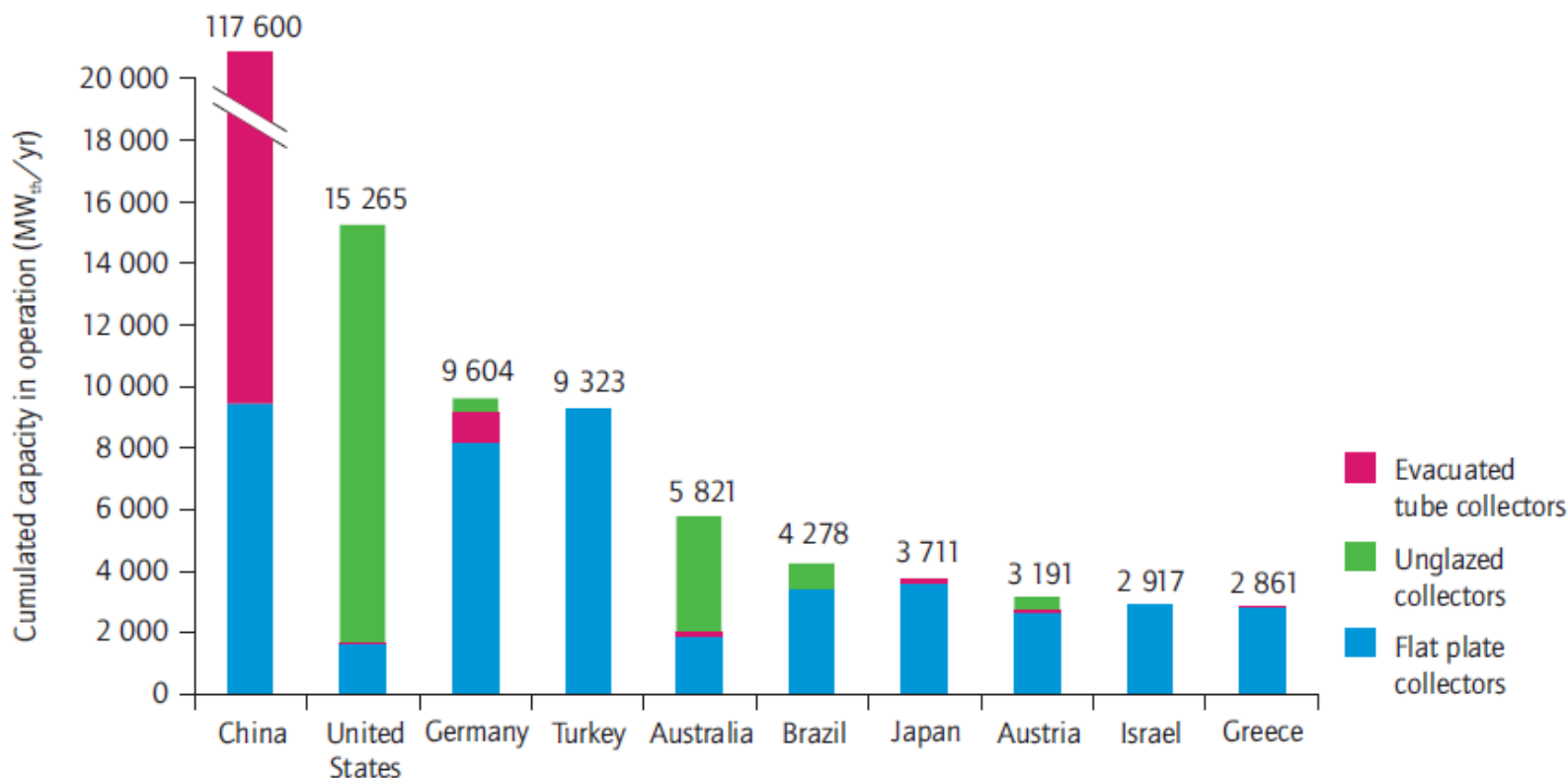


Data for 2003, 32 Countries: EU25 + Bulgaria, Romania, Turkey, Croatia, Iceland, Norway and Switzerland.

Source: ECOHEATCOOL (IEE ALTENER Project), The European Heat Market, Work Package 1, Final Report published by Euroheat & Power

Solar heating and Cooling Today

- **By the end of 2010, solar thermal collector capacity in operation worldwide was 195 GWth (60% installed in China)**

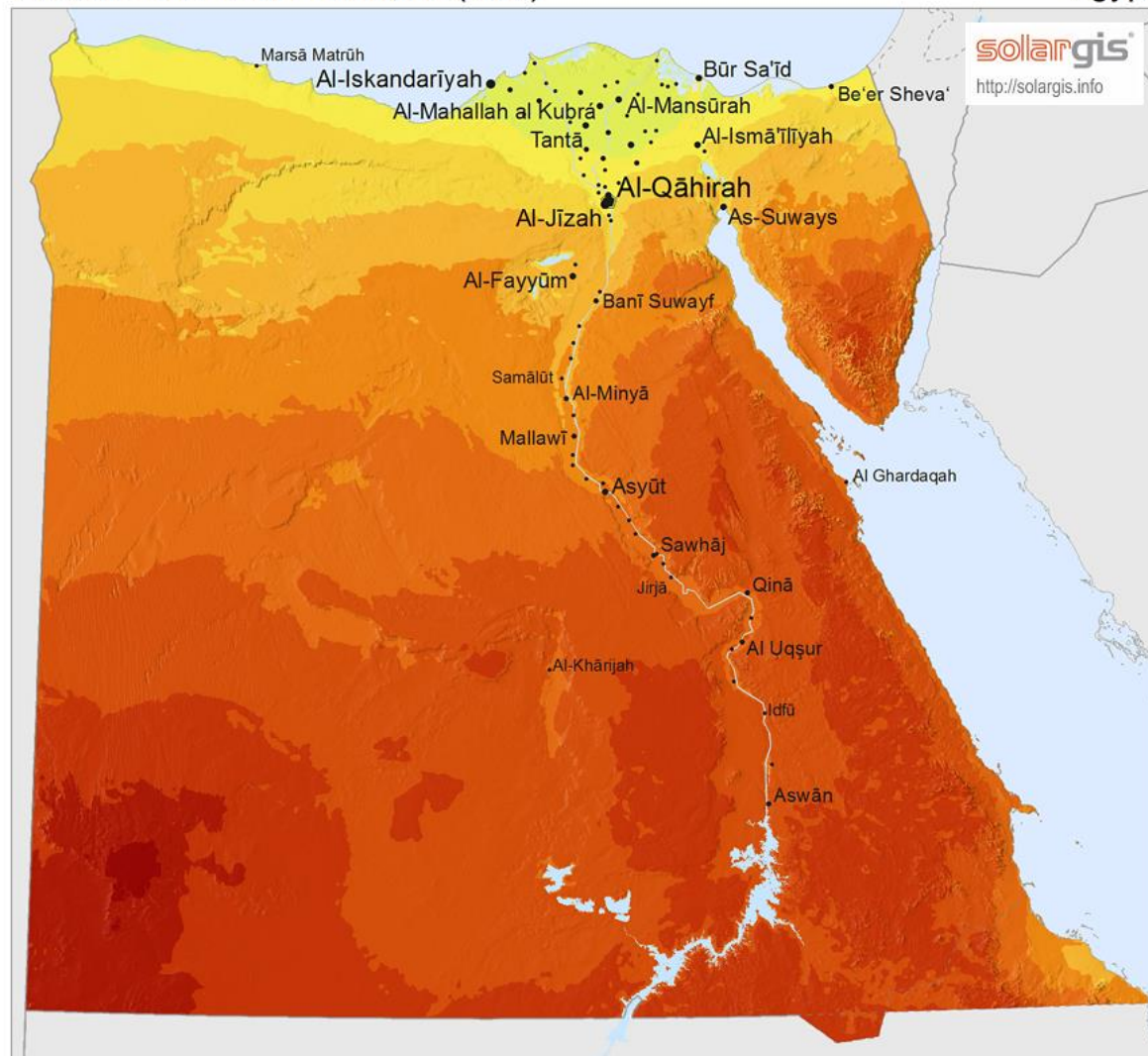


Source: Weiss and Mauthner, 2012.

Solar Irradiation Egypt

Global Horizontal Irradiation (GHI)

Egypt



Average annual sum, period 1994-2010



SHIP potential in Egypt – Relevant Industries

Industry/Score per Category	Tem. Level per Industry	Energy profile	GDP Share	Energy consumption per sector	Solar share	Investment potential	Final Score
Food	0,2	0,2	0,2	0,1	0,2	0,4	1,3
Agriculture	0,2	0	0,4	0,1	0,1	0,4	1,2
Textile	0,2	0,1	0,2	0,1	0,2	0,4	1,2
Surface treatment	0,2	0,2	0	0	0,2	0	0,6
Chemical Industry	0,2	0,2	0,2	0,1	0,1	0,8	1,6
Pulp and Paper	0,1	0,1	0	0	0,1	0	0,3
Leather	0,1	0,1	0	0	0,2	0	0,4
Wood	0,1	0,1	0	0	0	0	0,2
Rubber and plastics	0,1	0,1	0	0	0,1	0	0,3
Pharmaceuticals	0,2	0,2	/	/	0,2	/	0,6
Glass	0,1	0,1	0	0	0	0	0,2
Building materials	0,1	0,1	/	/	0,2	/	0,4

Source: IFC 2014 „Market Study for Solar Thermal Energy in Industrial/Commercial Use (Egypt, Pakistan, Morocco)

SHIP potential in Egypt – Investment potential

Industry		Under current market conditions				Given the removal of subsidies for conventional energy supplies			
		Investment potential short term (payback <10 year) [Mill. USD]	Investment potential long term (payback 10-20 years) [Mill. USD]	CO ₂ reduction [thousand tons/a]: short-term	CO ₂ reduction [thousand tons/a]: long-term	Investment potential short term (payback <10 year) [Mill. USD]	Investment potential long term (payback 10-20 years) [Mill. USD]	CO ₂ reduction [thousand tons/a]: short-term	CO ₂ reduction [thousand tons/a]: long-term
EGYPT	Tourism	0	226.5	0	195.4	1.181,8	183.0	565.6	51.4
	Chemical	0	110.7	0	334.2	1.099	312.9	515.1	87.9
	Food	0	96.1	0	186.5	727.8	174.6	343.6	49.1
	Textile	0	36.1	0	100.0	338.6	93.6	159.0	26.3
	Agriculture	0	27.9	0	67.1	239.8	62.9	112.8	17.7

Source: IFC 2014 „Market Study for Solar Thermal Energy in Industrial/Commercial Use (Egypt, Pakistan, Morocco)

SHIP potential in Egypt – Collector Area

Industry	Collector area for industrial processes with 50 °C [m ²]	Collector area for industrial processes with 70 °C [m ²]	Solar contribution (with 50 °C) [MWh/a]	Solar contribution (with 70 °C) [MWh/a]
Tourism	786.370,00	635.244,00	877.590,00	585.060,00
Chemical	384.254,03	1.086.425,08	428.827,00	1.000.597,00
Food	333.620,07	606.384,36	372.320,00	558.480,00
Textile	125.173,61	325.020,36	139.693,00	299.343,00
Agriculture	96.980,73	218.240,50	108.230,00	200.999,00

Table 3-15: Potential solar contribution for top ranked industries, Egypt

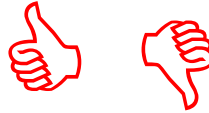
Note: Estimated collector area refers to maximal array area that could be implemented for a certain industry, based on estimated solar share (expected maximum share that low temperature solar applications can contribute to the final energy consumption per sector) and average solar yield.

Source: IFC 2014 „Market Study for Solar Thermal Energy in Industrial/Commercial Use (Egypt, Pakistan, Morocco)

Methods

Which formular is not energy related? (or which one is wrong?)

$$Q = m \cdot c_p \cdot dT$$



$$\eta = \frac{W}{Q_H} = 1 - \frac{T_C}{T_H}$$

$$P = U \cdot I \cdot \sqrt{3} \cdot \cos \varphi$$

$$E = h\nu$$

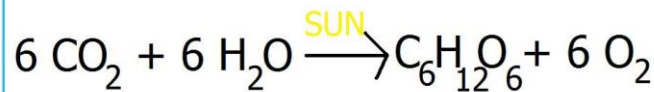
frequency of
Quantum of a
h = Planck's constant = 6.626 x 10⁻³⁴ Joule-se

$$P = v \cdot A \cdot \rho \cdot c_p \cdot (T_1 - T_2)$$

$$F_{air} = \frac{\rho_{air}}{2} \cdot c_W \cdot A \cdot v_{rel}^2$$

$$E = P \cdot t$$

$$\frac{t}{V_{(t)F}} = \frac{\eta \cdot \alpha \cdot y'}{2 \cdot A^2 \cdot \Delta p} \cdot V_{(t)F} + \frac{\eta \cdot \beta}{A \cdot \Delta p}$$



$$h_f = f \frac{L}{D} \frac{V^2}{2g}$$

3 important steps

➤ (1) Process optimisation

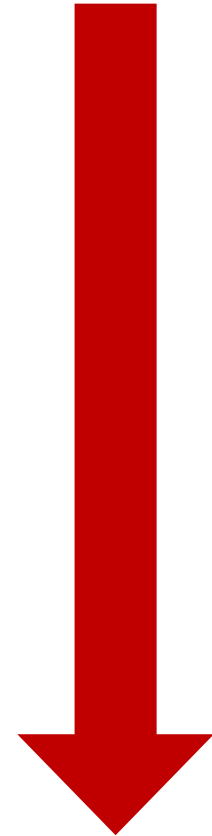
- ⇒ Improve the production process itself
- ⇒ New technologies

➤ (2) System optimisation

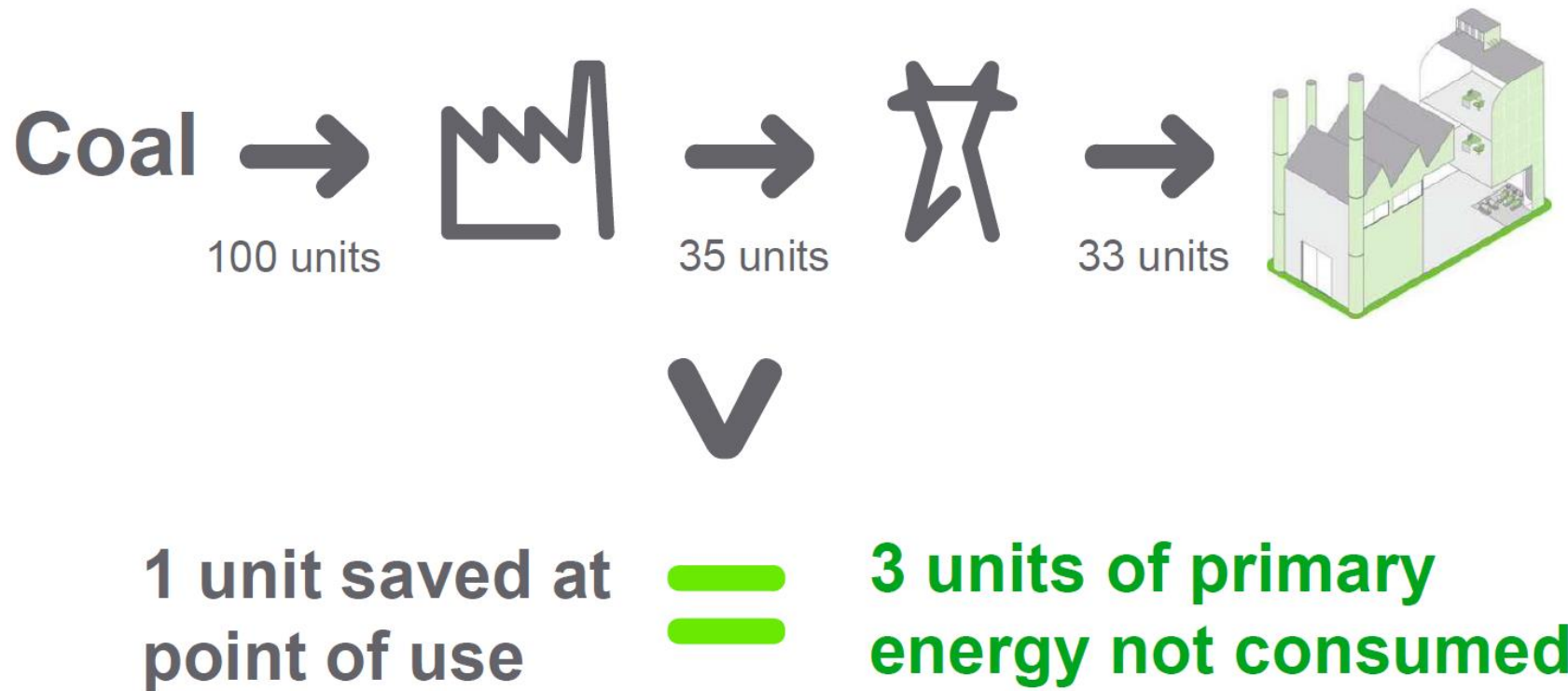
- ⇒ Optimize the energy system
- ⇒ Heat recovery

➤ (3) Renewables

- ⇒ Provide clean forms of energy
- ⇒ e.g. Solar process heat



How to increase supply and decrease emissions? Efficiency counts triple!



- Where is your energy coming from?
- Why is there load shedding?

Cost of Energy USD

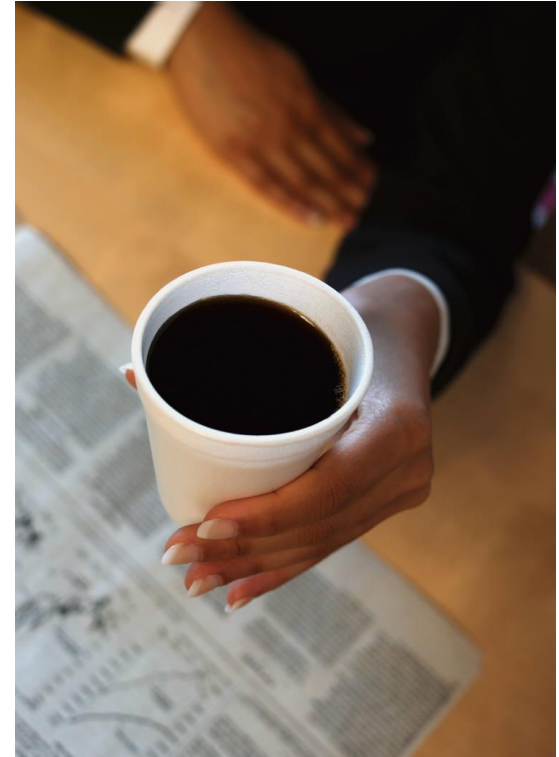
@1 EGP = 0.051 EUR = 0.055

- **Electricity**
- **Electricity from Diesel**
- **Diesel**
- **Petrol gas (LPG)**
- **Natural gas (grid)**
-
- **Steam** **1 MWh = 1.8 t**
 - ⇒ $\eta \sim 50\% \rightarrow 2 \text{ MWh} = 2 \text{ t}$
1 t =
- **Compressed air** **0.130 kwh/m³ →**
- **Cooling** **COP 3 →**
 - ⇒ 3.5168 kW = 1 TR cooling

Organisation

- **Coffee/tea and lunch breaks**
- **Breaks**
- **Lunch**
- **Dinner**
- **Signature list**
- **Emergency exits**
- **Restrooms**
- **WiFi**

- **Laptops**
- **Training materials**
- **Evaluation**







SHIP Egypt

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