TrustCS

Business and financial models for solar heat in the industrial sector

Business models

Business models for solar heat for industrial processes

Common Basis of all business models:

Replace uncertain future conventional operational heat costs by well-known initial investment costs

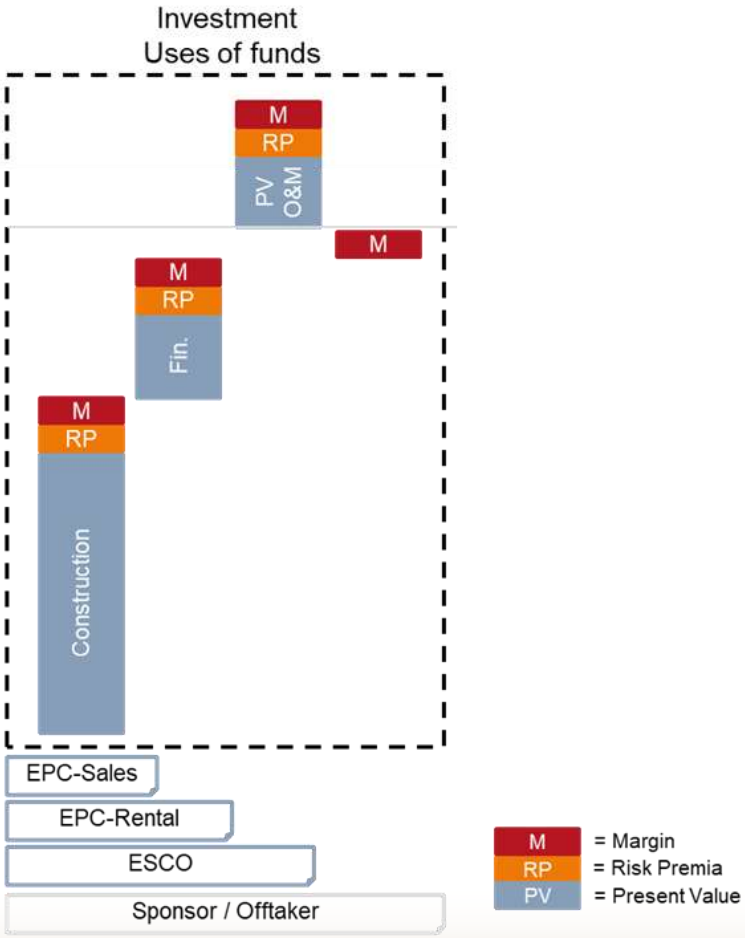
- cost-reduction in energy
- reduce risk of energy price inflation
- long-term cost stabilization

Three business models for solar heat for industrial processes

Differentiation of three business models according to the three main different services necessary to replace the costs of conventional heat by sustainable and renewable heat.

To build	• **EPC - Sales Model** • Engineering, Procurement and Construction (EPC) for the technical implementation,
To finance	• **EPC – Rental Model** • For the financing of the initial investment costs of the renewable heat plant,
To operate	• **ESCO – Model** • Energy Servicing Company (ESCO) to operate the renewable heat plant during its life time.

Business models for solar heat for industrial processes



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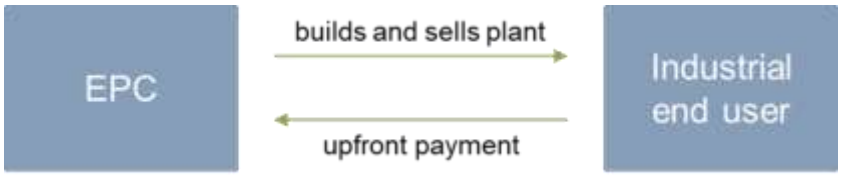
Standardized description of business models with the St. Gallen Business Model Navigator (BMN)

Standardized description of three business models from a metaperspective using four dimensions: the Who, the What, the Value and the Why

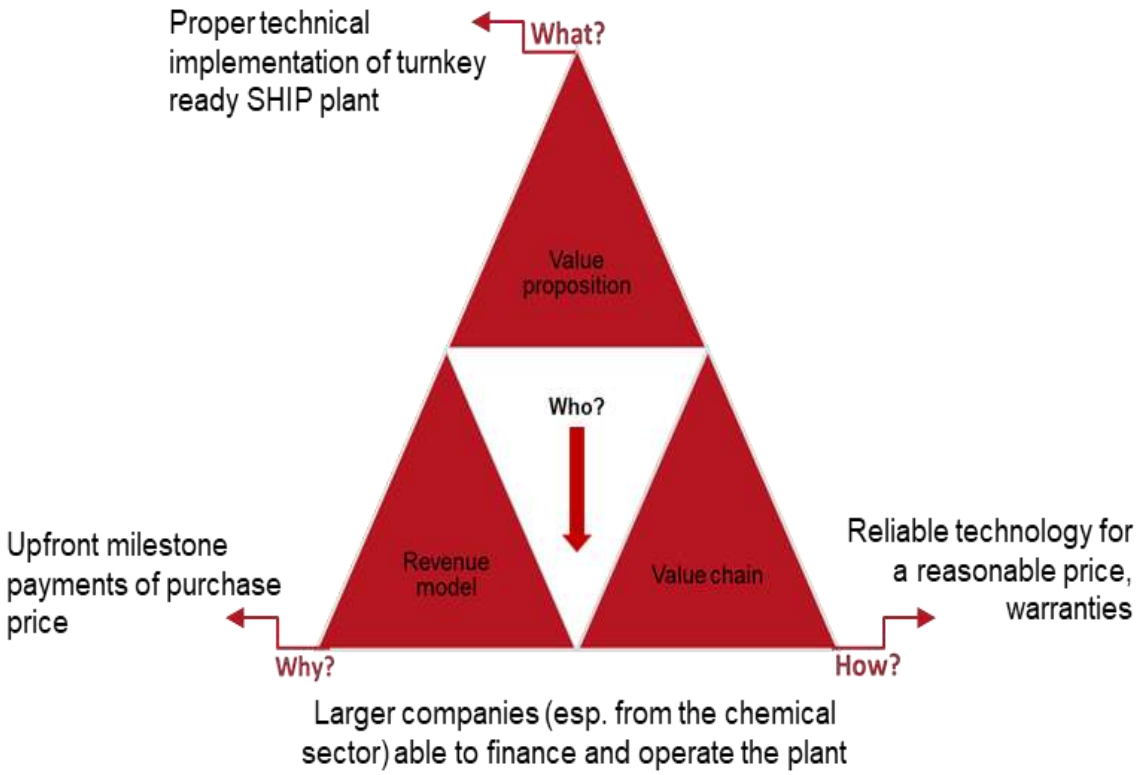
- **Who** are the business‘s target customers?
- **What** kind of value proposition does the business offer its customers?
- **How** does the business model create **value** for its customers?
- **Why** does the business model generate profit?

Turnkey supplier - EPC Sales model

- An engineering, procurement and construction (EPC)-contractor
  - purchases all necessary parts and services for commissioning of the plant and then transfers the plant to the client/off-taker.
  - takes all risks related to the construction phase and therefore requires a considerable margin on top of the pure margin-free investment costs.
- During construction or latest at commissioning the client pays the purchase price of the plant according to contractually agreed milestones. The financing of the purchase price rests with the client or heat consuming/off-taking company.



Turnkey supplier - EPC Sales model



Turnkey supplier - Sales model

- Self-ownership of the asset

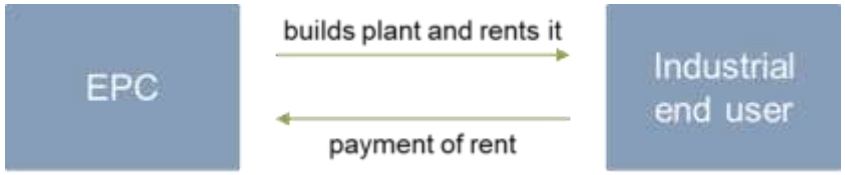
- High initial investment cost
- Full liability after expiry of manufacturer‘s warranties
- Internal expertise and resources for system operation required

Possible users

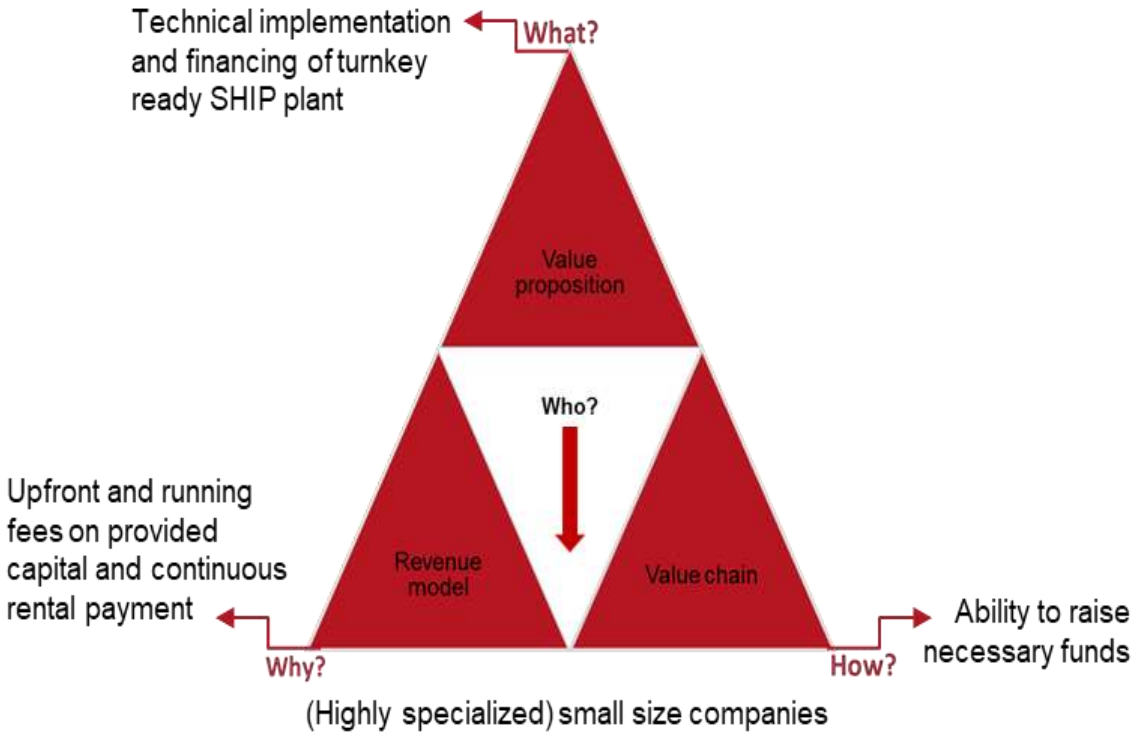
Companies with sufficient internal resources to finance the purchase price (on-balance) and operate the plant

Turnkey supplier - Rental model

- An engineering, procurement and construction (EPC)-contractor
  - Not only builds the plant but also raises the necessary funds to finance it most likely on his own balance sheet
- Instead of receiving a purchase price for the plant from the off-taker at commissioning, the EPC will own the plant and charge the off-taker a continuous rental payment for using the plant.
  - This rental payment covers of course at least the EPC's (re-)financing costs as well as risk premia, and additional upfront and running margins.



Turnkey supplier - Rental model



Turnkey supplier - Rental model

- No initial investment cost

- High leasing fees
- Internal expertise and resources for system operation required

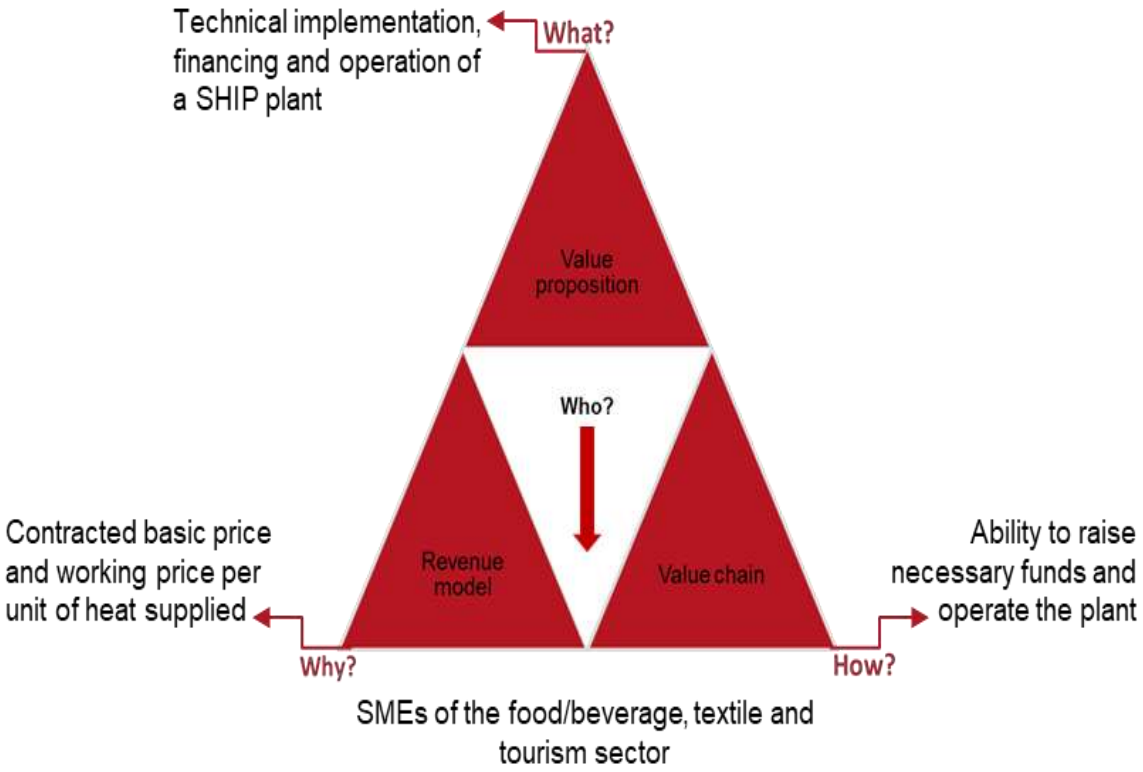
Possible users

Companies lacking the ability to finance the initial investement costs.

ESCO model

- The energy servicing company (ESCO) provides the service to operate the renewable plant that generates the heat delivered to the off-taker.
- The ESCO may be able to offer long-term price stability and thereby stabilize the potential future value added of the off-taker as his costs of heat become more stable and plannable.
- The major cost component of the renewable heat is initial investment cost (CapEx) annualized into interest- and re-payment that are mostly fixed.
- The ESCO will charge his original cost of operation (i.e. the plant's OpEx) plus a profit margin and risk premia to cover all risks related to the operation of the plant.

ESCO model


Technical implementation, financing and operation of a SHIP plant
What?
Value proposition
Who?
Revenue model
Value chain
Contracted basic price and working price per unit of heat supplied
Ability to raise necessary funds and operate the plant
Why?
How?
SMEs of the food/beverage, textile and tourism sector

ESCO model

- No initial investment cost
- All inclusive package – no profound expertise on the off taker's side needed

- All-in service is reflected in the price of the heat.

Possible users

Companies that outsource the operation of the plant and favor a simple but more expensive and less profitable solution.

Due to high off-taker risk for the EPC rental and ESCO model
→ Companies on industrial parks are particularly interesting

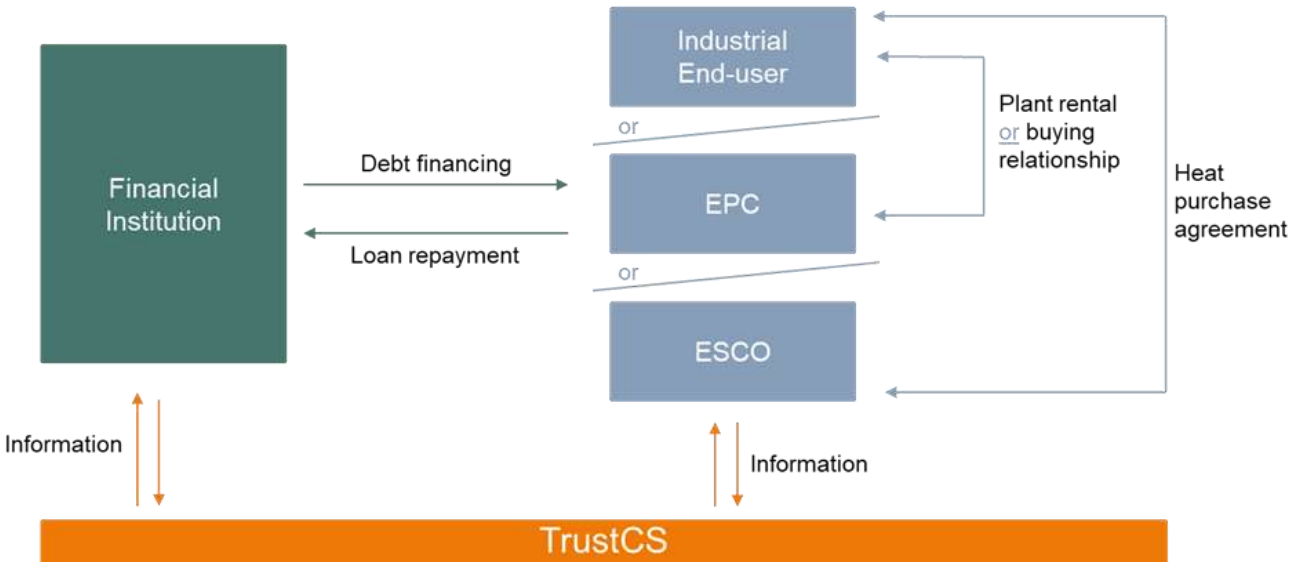
Financing options

Financing options for solar heat for industrial processes

3 Options

- Corporate debt finance
- Leasing
- Investment fund

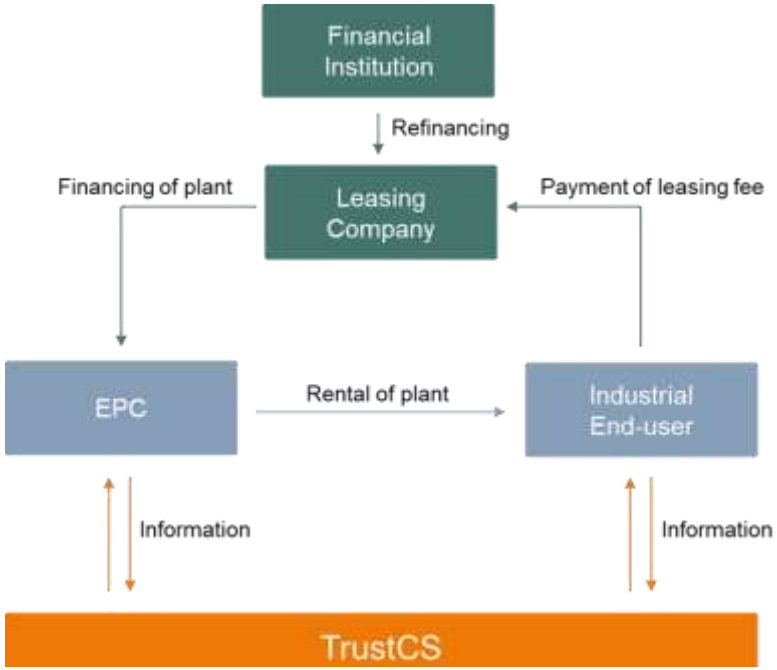
Corporate debt finance



Corporate debt finance – Pros/Cons

Pros	Cons
• Lowest borrowing costs as compared to leasing / investment fund • Regular payments through financing period • Possibility of grace period during construction period	• Client must have some equity for the purchase of the SHIP plant • Necessity of bankable collateral • ESCOs: only interesting for banks if the ESCO has a strong client base

Leasing


Financial Institution
Refinancing
Financing of plant
Leasing Company
Payment of leasing fee
EPC
Rental of plant
Industrial End-user
Information
Information
TrustCS

Leasing – Pros/Cons

Pros for lessor	Cons for lessor
• Extension of target market as compared to turnkey sales model • Little risk – ownership remains with lessor • Lessor receives regular payments	• In operative leasing: Potentially higher than projected costs for maintenance & replacement of erratic equipment
Pros for lessee	**Cons for lessee**
• No initial investment cost • No collateral required • Tax benefits from leasing rate expenses • Regular payments throughout the financing period • Short term leasing possible	• Higher costs than in corporate debt finance • Limited eligibility (more likely for standardized SH plants) • No value increase of the end-user's business site during leasing period

Investment or guarantee fund

- Specialized investment funds provide another option of financing by providing external funding to substitute either the necessary equity or the total investment volume.

Pros for investor	Cons for investor
• Higher financial return than in alternative investment options	• In case of default, investors loose their invested capital
Pros for end-user	**Cons for end-user**
• Lower risk → if business falls, no repayment of capital.	• Higher borrowing costs for the debtor as compared to financial institutions (due to higher risk for the investors) • Some equity for the purchase of the SH plant required • Only larger (medium-sized) companies eligible due to the high effort in due diligence.

Recent experiences in Mexico

- Currently predominant model: EPC – Sales model
  - End-users seem to have either relevant own capital resources or good access to bank finance
  - Big companies tend to finance these investments with equity >> tend to have IRR < borrowing costs
  - Show tendency to own assets
- But locally given investment constraints such as
  - short amortization periods (2-4 years)
  - certain given required rates of return for SMEs

Techno-Economic Feasibility Assessments Simplified Calculation Sheet

Support of pre-feasibility and feasibility studies

- Simple Estimation of annual yield of SHIP plant under individual conditions
- Financial evaluation
- Environmental impact

Input Parameter

Heat Demand

Solar Installation

Financial Conditions

Technical Input Parameter

Heating System

- Heat transfer media (water/oil)
- Annual heat demand
- Operation hours
- Load profile/schedule (24h, daytime operation)
- Outlet boiler/heater conditions (temperature, pressure)

Solar Installation

- Irradiation from internet map
- Type of installation (flat plate/concentrating system)
- Targeted solar fraction and storage size

Economic Input Parameter

System Cost

- Invest
- Simple Opex estimation
- Conventional heat cost

Financing

- project life time
- assumed inflation rate of energy
- effective interest rate of cost

Output
KPI: Economic performance

- Payback time (static, dynamic)
- Net present value (NPV)
- Internal rate of return (IRR)
- Levelized cost of heat (LCoH)
- …

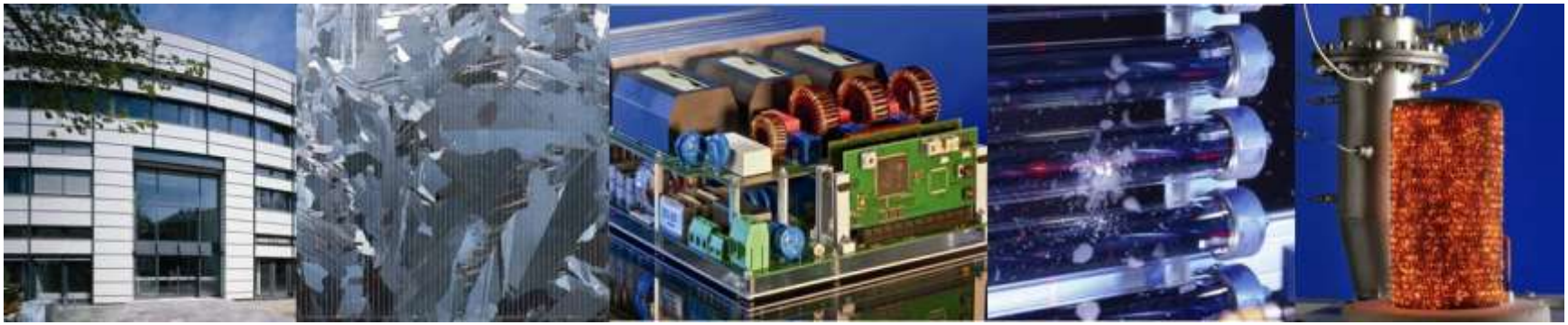
Output
KPI: Environmental performance

- Savings of CO_2-emissions

Economic Feasibility

	Parameter	Unit	Value
		round by	1.000
5	Annual yield	MWh	900
6	CAPEX or investment	US$	350.000
7	Operational expenditures	US$/a	7.000
8	Conventional/comparative heat/energy costs CHC	US$/MWh	55
9	Project lifetime	a	20
10	Weighted Average Cost of Capital (WACC)	%/a	12,5
11	Inflation rate	%/a	5,0
12	Effective rate (of cost of capital, COC)	%/a	13,0
13	Effective rate adjusted for inflation	%/a	7,6
14	Free cash from saved costs	US$/a	42.500
15	Annuity factor based on inflation-adj. COC	-	10,1
16	**Project present value based on effective rate**	**US$/a**	**429.000**
17	**Project margin = project value - CAPEX = NPV**	**US$**	**79.000**
18	**Project return on investment**	**%**	**16**
19	**Simple payback period for CAPEX excl. COC**	**years**	**7**
20	Discounted payback period for CAPEX incl. COC	years	13
21	LCOH (initial cost inflating over lifetime)	US$/MWh	46
22	LCOH (average cost constant over lifetime)	US$/MWh	63

Thank you for your attention!



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