Egyptian German Joint Committee on Renewable Energy, Energy Efficiency and Environmental Protection

جهاز تنظيم مرفق الكهرباء وحماية المستهلك
Egyption Electric Utility & Consumer protection Regulatory Agency

LAHMEYER INTERNATIONAL

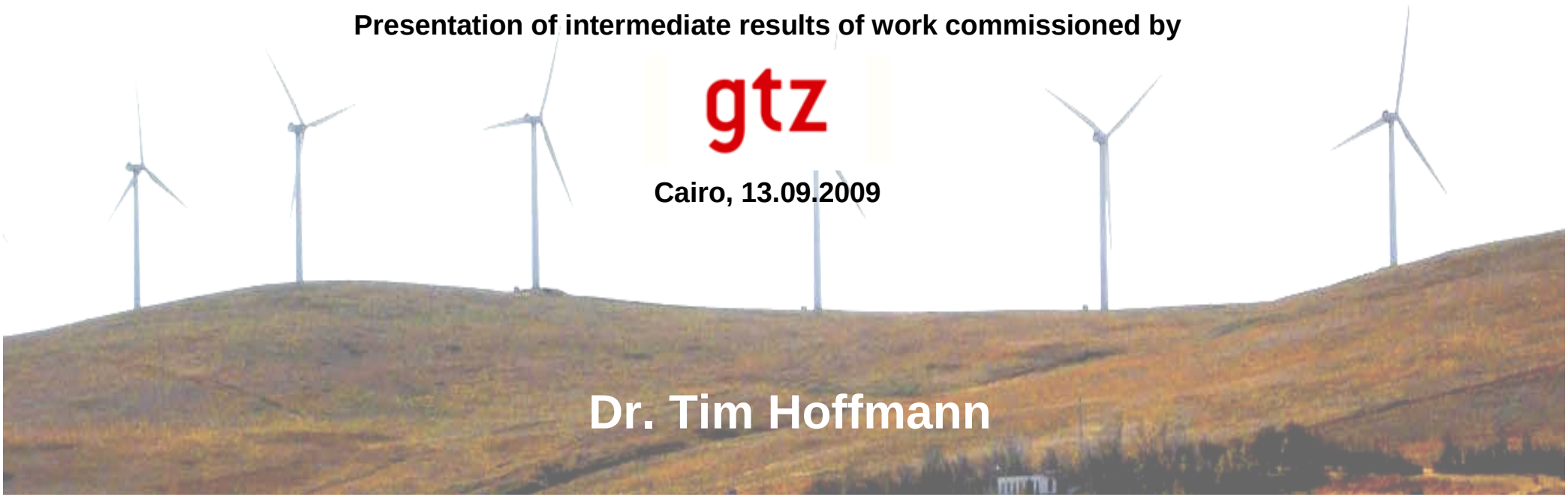
Feed in Tariffs for Wind Power in Egypt

Design Issues, Proposals, Next Steps

Presentation of intermediate results of work commissioned by

gtz

Cairo, 13.09.2009

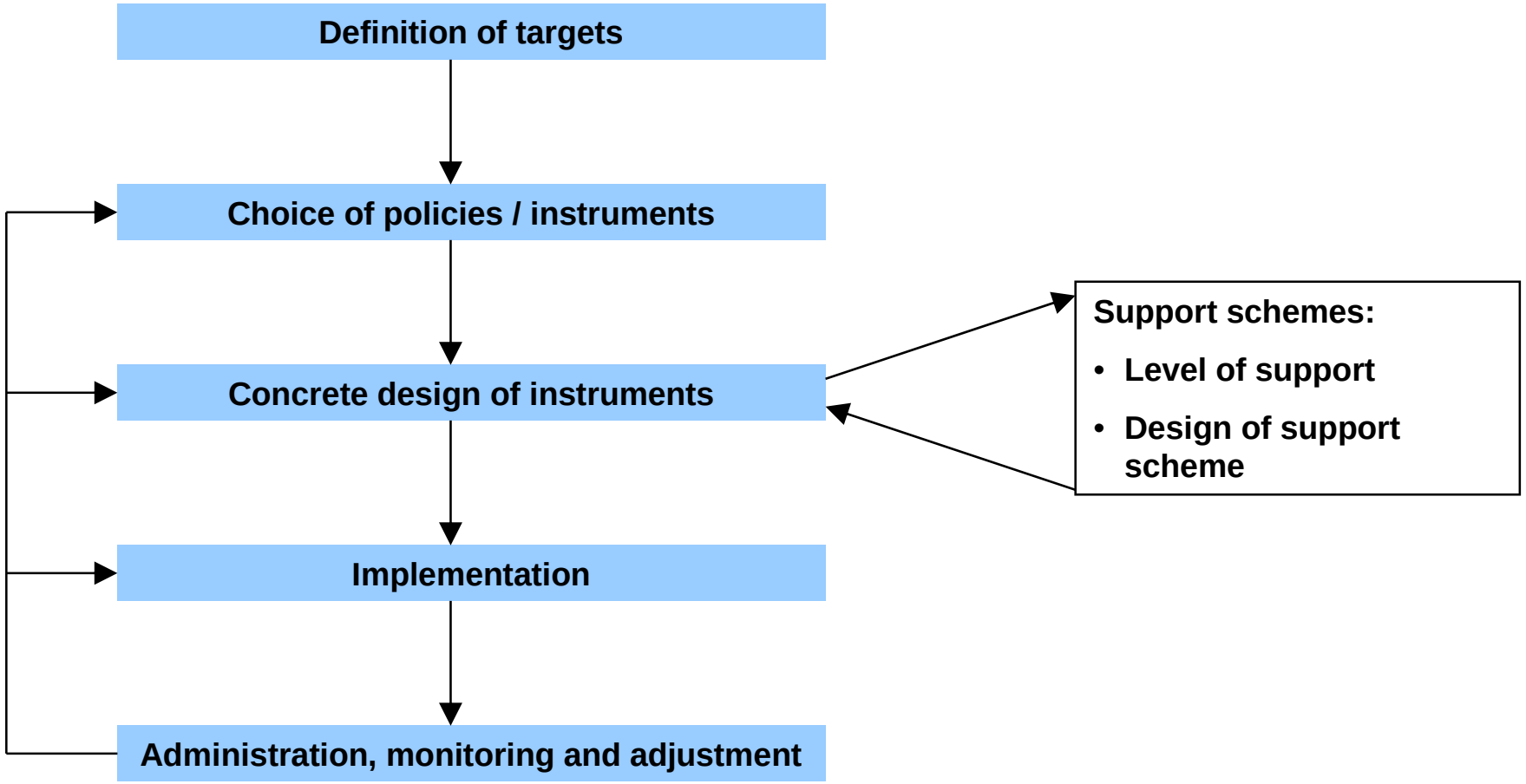


Dr. Tim Hoffmann

Agenda I:

I	FEED-IN TARIFFS – BACKGROUND & CONCEPTS
II	OPTIONS FOR FIT-DESIGN
III	TOOLBOX & CASE STUDY
IV	CONCLUSIONS & NEXT STEPS

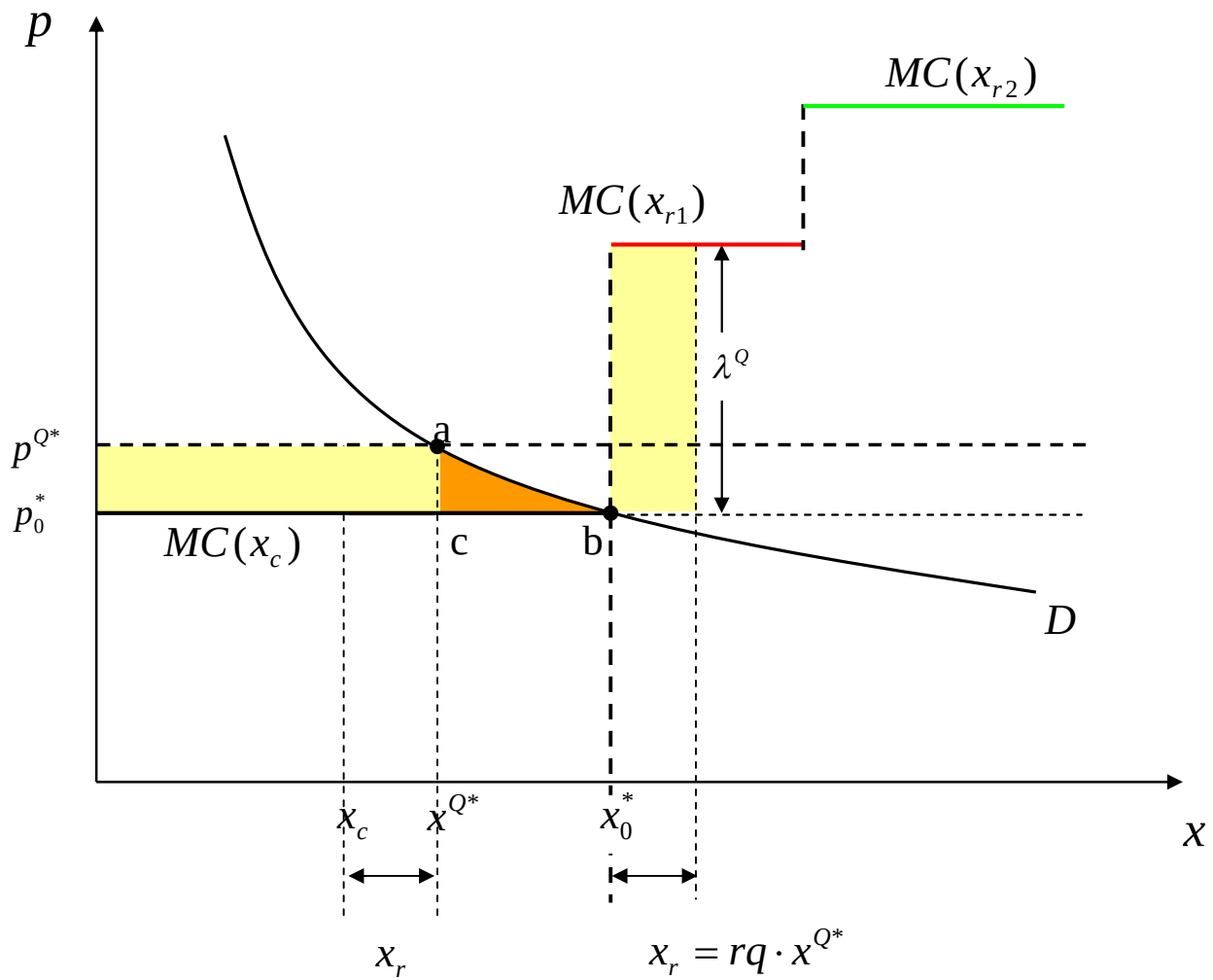
Designing RE-Policies:



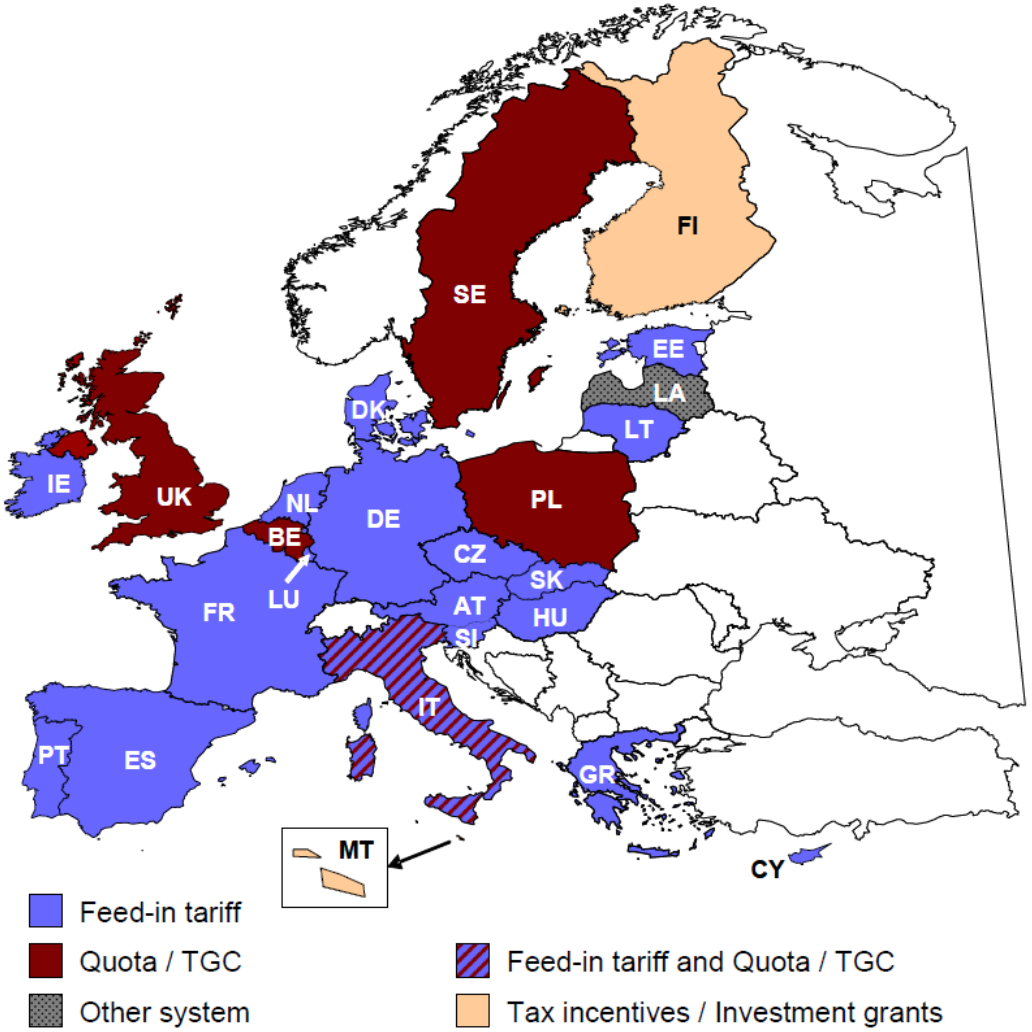
Feed-In Tariffs – The Basic Idea:

Provide a per unit tariff or premium for (grid-connected) renewable energy generation, that:

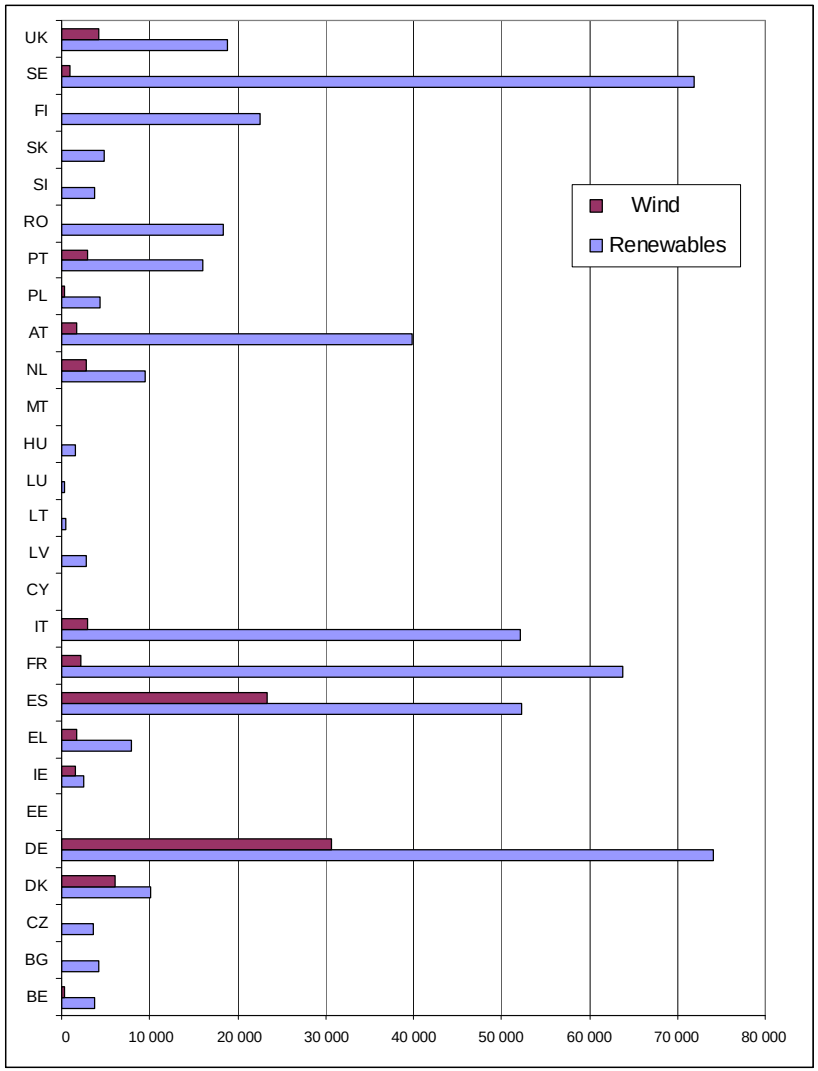
- Ensures economic vialbility of RE-Project
- Reduces investment risk to manageable level
- Based on either
  - energy cost,
  - avoided cost of utilities
  - or on electricity tariff



RE-Promotion in the EU:



Electricity Generation from RE and Wind [GWh]



Agenda II:

- I FEED-IN TARIFFS – BACKGROUND & CONCEPTS
- II OPTIONS FOR FIT-DESIGN
  - II.1 Trade-Offs and Feed-In Tariffs
  - II.2 Presentation and Discussion of Options
  - II.3 Open Questions
- III TOOLBOX & CASE STUDY
- IV CONCLUSIONS & NEXT STEPS

Trade-Offs:

Sufficient promotion vs. economic cost:

- Investor‘s perspective: Ensure adequate level of return
- Economy‘s perspective: Avoid over subsidisation and keep total (economic) cost of promotion scheme low

Diverse promotion vs. manageable administration:

- Project‘s perspective: Cover a wide range of possible options and acocunt for specific needs
- Administration‘s perspective: Keep system manageable and transparent

➔ Ensure efficient achievement of targets

Specific Design Options:

- **Eligibility:**
  - Which installations are covered
  - Limitations and requirements
- **Framing scheme and tariffs**
  - Timframe
  - Technology-specific options
  - Site-specific options
  - Tariff levels (magnitude and development over time)
- **Administrative Procedures**
  - Payment terms
  - Contarctual relations / PPA

Eligibility I – Capacity Limitations:

- **Capacity Limitations:**
  - Problem of defining the „correct“ minimum and / or maximum capacity
  - Small sizes involve local communities (cooperatives)
  - Large sizes attract foreign investment as well
  - Technical Constraints?

- **Production limitations**
  - Revenue Cap: Only production up to specified limit is remunerated
  - Tariff design can lead to equal economic effects

➔ **Conclusions:**
  - No economic reasons for capacity or production limitations
  - Technical constraints for small sizes may matter
  - Upper capacity limit determines border to other wind power programs in Egypt (tenders)

Eligibility II – Local Content:

- **Economic considerations:**
  - Danger of over-regulation
  - Information problem: What is the optimal (desired) share of local maufacturing
  - Creation of regional market distortions / imperfections (regional monopolies) → Effect: higher prices for locally manufactured goods and services

- **Administrative considerations:**
  - Monitoring of compliance (Problems in determining the share)
  - Penalties for non-compliance

→ **Conclusions:**
  - Economic point of view: No good reason for local content obligations
  - Dangerous market distortions, artificial creation of market structures
  - Local industry will profit from scheme anyway (if competitive)

Payment Terms – Currency:

- **Developper‘s Perspective:**
  - Several currencies involved in investment and operation (machinery, loans, construction, staff)
  - Exchange rate risk – since revenues usually in one currency
  - Limited ability of very small developers to hedge against exchange rate risks

- **Options:**
  - Payment of revenues (tariffs) in one currency (either domestic or foreign)
  - Proportionate payment of revenues according to specific shares

➔ **Conclusions:**
  - Major share of CAPEX will be paid in foreign (US$) currency
  - Foreign currency → Base currency
  - Determination of exchange rates in order to minimise exchange rate risks

Framing the Scheme – Timeframe:

Duration of feed-in tariff payment – ceteris paribus considerations:

- **Short periods:**
  - Shorter periods promote quicker capital amortisation and reduce risk, but
  - Demand higher tariff rates in order to guarantee for desired project-specific profits over time (e.g. rate of return)

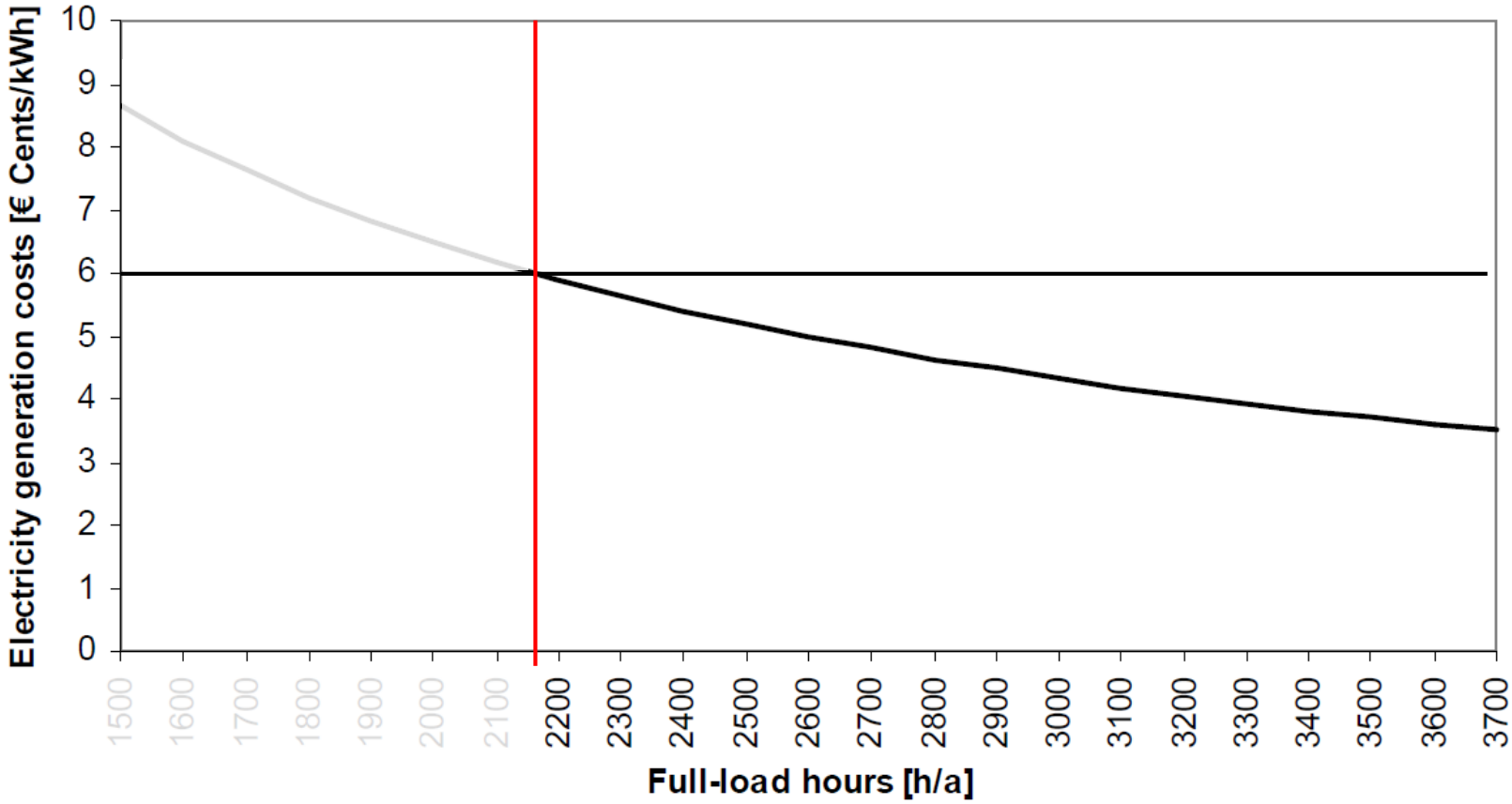
- **Long periods:**
  - Longer periods can reduce tariff levels, but
  - Potentially lead to Lock-In effects (committment to long-term tariff payments to potentially outdated installations)

- **Options:**
  - Split between tariff payments with incentive and tariff payments without incentive component
  - Maybe PPA-duration: 20 years, FIT-duration: 15 years

➔ **PROBLEM:** Definition of tariff after FIT

Framing the Scheme – Technology & Site:

Accounting for site quality:



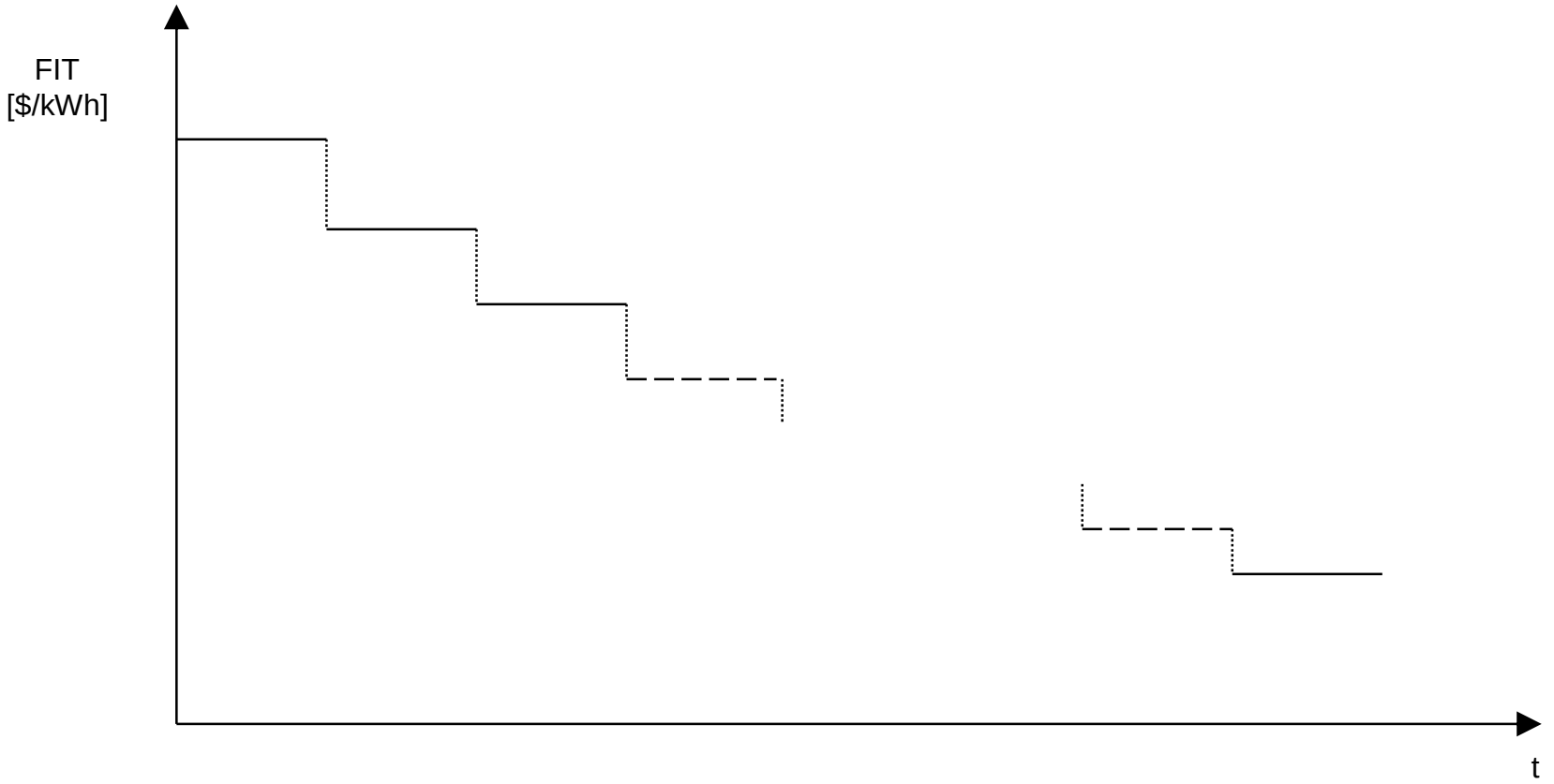
Framing the Scheme – Technology & Site:

- **Discussion:**
  - \+ Ensures high level of adequacy and project orientation
  - \+ Can ensure similar conditions for wind power developers in Egypt (under the FIT)
  - \+ Reduces over-subsidisation of favourable sites
  - \+ Reduces inefficient subsidisation of poor sites
  - – Danger of intransparency and overcomplexity
  - – Demands high level of information in order to be effective and efficient
  - – Danger of over-regulation and undesirable interdependencies between technologies and sites

- **Recommendations:**
  - → Useful under regional and development considerations
  - → Top-Down apporoach: Ensure transparency and simplicity
  - → Needs monitoring & generation of structured database

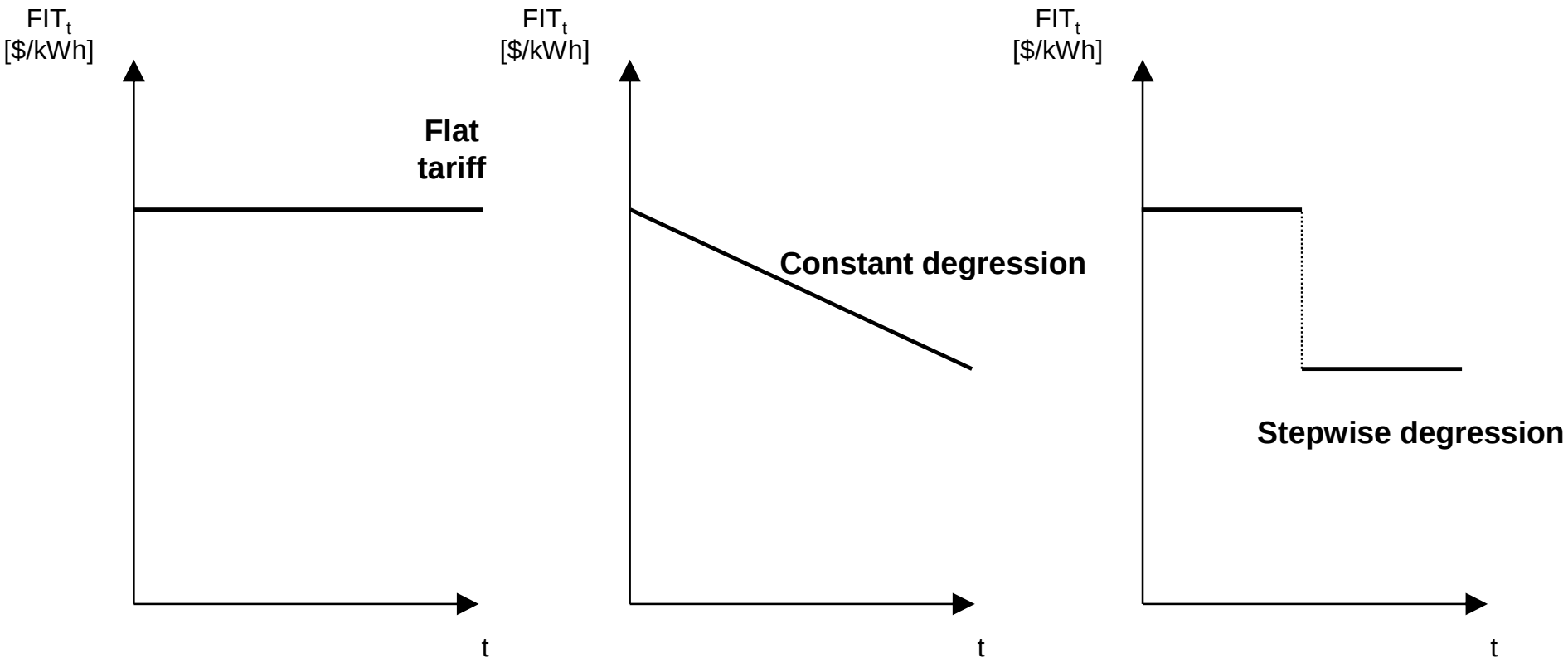
Framing the Scheme – Tariff Degression:

Inter-Project Degression:



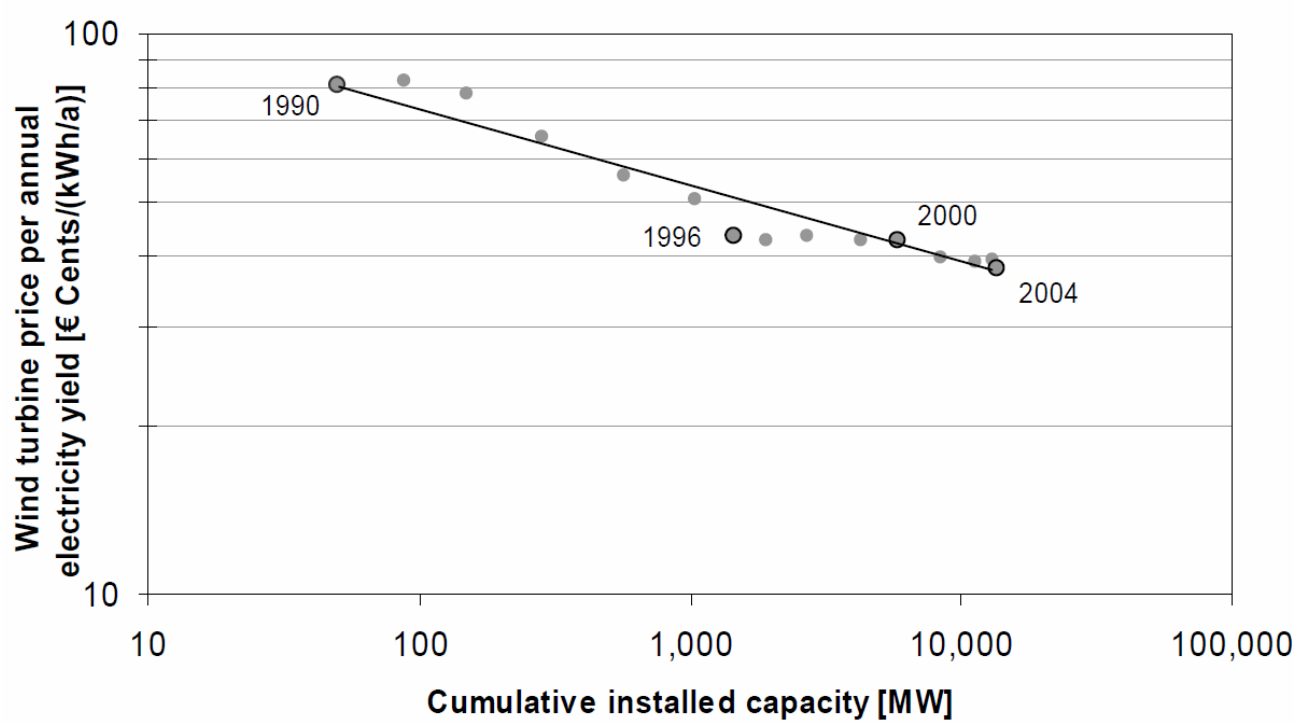
Framing the Scheme – Tariff Degression:

Intra-Project Degression



Framing the Scheme – Inter-Project Degression:

Accounting for technological progress:



Framing the Scheme – Inter-Project Degression:

- **Discussion:**
  - \+ Transparency, Planning and investment security
  - \+ Incentive for early committment of investors
  - \+ Technological improvement
  - \+ Reduced cost and burden for economy
  - – Potentially inflexible (no reactions on world market developments)
  - – Technological learning difficult to predict

- **Recommendations:**
  - → Inter-project degression is useful
  - → Demand for constant monitoring and adjustment
  - → Needs additional (prospective) analysis

Framing the Scheme – Intra-Project Degression:

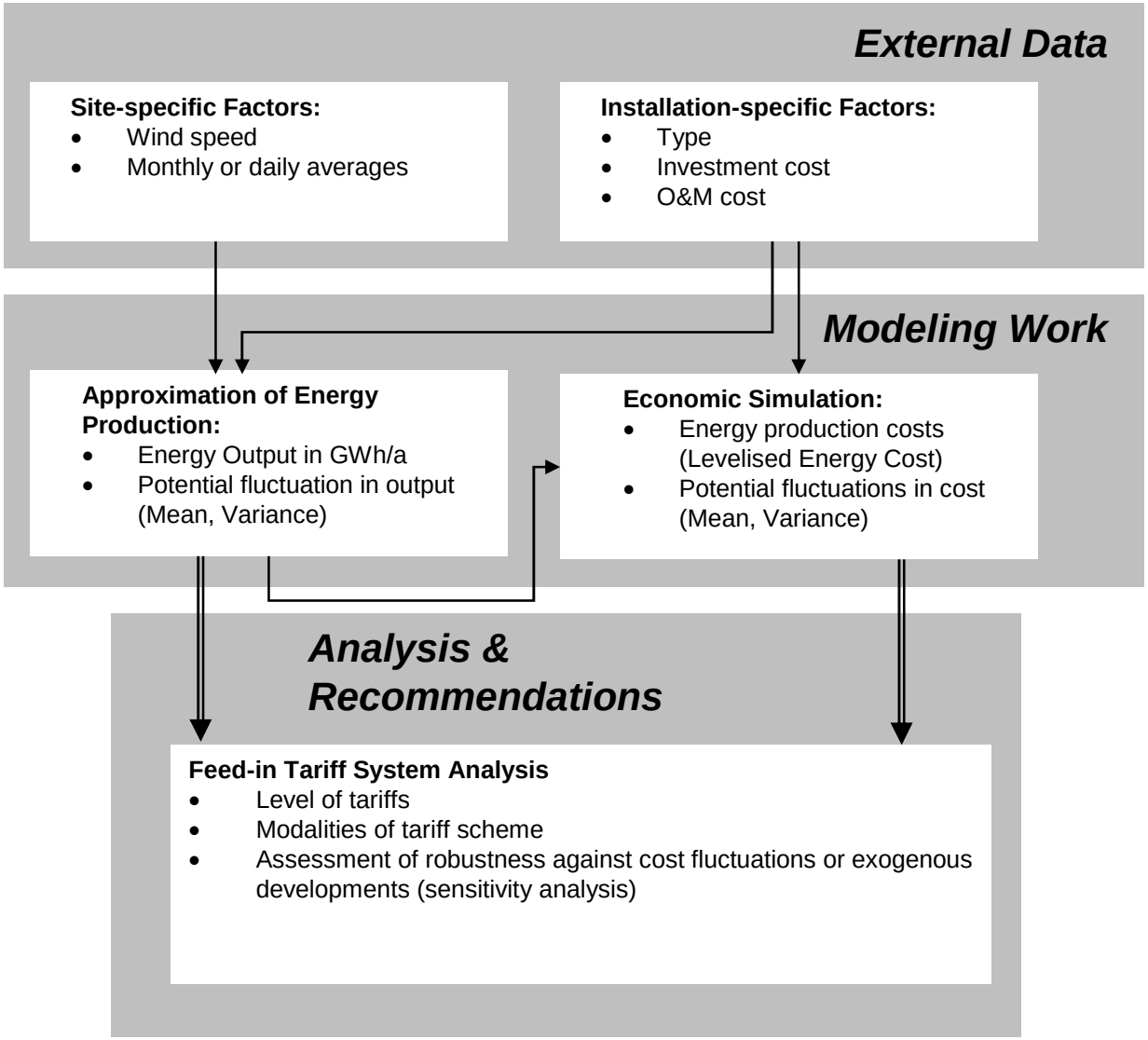
- **Discussion:**
  - \+ Accounts for investor‘s (financing) needs
  - \+ Minimises support after debt has been served
  - \+ Reduces overall (economic) cost
  - \+ Levelises cash-flows over project lifetime
  - – Correct design depends on capital structure of projects
  - – May lead to over-subsidisation in some periods

- **Recommendations:**
  - → Intra-project degression is useful and sometimes needed (see case study)
  - → Detailed information on financing aspects of projects needed
  - → Analysis of interdependencies with FIT-duration and project lifetime needed

Agenda III:

- I FEED-IN TARIFFS – BACKGROUND & CONCEPTS
- II OPTIONS FOR FIT-DESIGN
- **III TOOLBOX & CASE STUDY**
  - **III.1 Modelling Concept**
  - **III.2 Case Study – Selected Results**
- IV CONCLUSIONS & NEXT STEPS

General Concept I



General Concept II:

Two different approaches:

Evaluation of exogeneously specified feed-in tariff schemes:

- Calculation of economic and financial indicators,
- Provide information on periodical cash-flows and net income of project
- Test tariff scheme for different sites

“Optimisation” of tariff schemes and levels –
Find tariff scheme that :

- Ensures economic viability for given wind power option at different sites
- Accounts for project-specific (re-) finaning needs
- Limits the profit from the project to exogeneously set bounds

General Concept III

General project-related results (reported):

- Feed-In tariff scheme as specified or as calculated
- Net Present Value of project
- Internal Rate of Return
- Levelised Energy Cost (LEC)
- Profit & Loss statement
- Cash Flow (Cash Waterfall)
- Balance Sheets
- Return on Equity

General project-related results (not reported):

- CAPEX
- Capital Draw Down Schedules
- Debt Service Calculations
- Asset depreciation
- Tax calculations

Results – Accounts

Profit & Loss Statement

REVENUES
Generation
Tariff
Revenues
OPEX
e.g. *Wages*
Admin. & Overheads
Operation Costs
Maintenance
Concession Fee
Real Estate Tax
Land Use
Operating Income (EBITDA)
Interest Expenses
Income before Depreciation & Ta
Depreciation
Earnings before Tax (EBT)
Income Tax
Net Income
Cumulated Net Income

Cash Waterfall

\+ Revenues
\- OPEX
\- Income Tax
\+ Equity draw downs
\+ Loan draw downs
\- CAPEX
Cash Available for Debt Service
\- Interest Payment
\- Capital Payment
\- Total Debt Service
-/+ Other Cash Items
Cash Available for Distribution
Cumulated CAD

Balance Sheets

Cumulated Assets
Cumulated Depreciation
Net Assets
Cash at Bank
Total Assets

Paid-in Equity
Retained earnings
Loan Balance

Exemplified Case Study:

- **Technology option:**
  Enercon E33 – 330kW
  - 1.200US$/kW
  - O&M: 3% of Investm.
  - Lifetime 20 years
  - Financing: 30% Equity
    Loan Interest Rate: 11.5%
    Repayment Period: 7 years

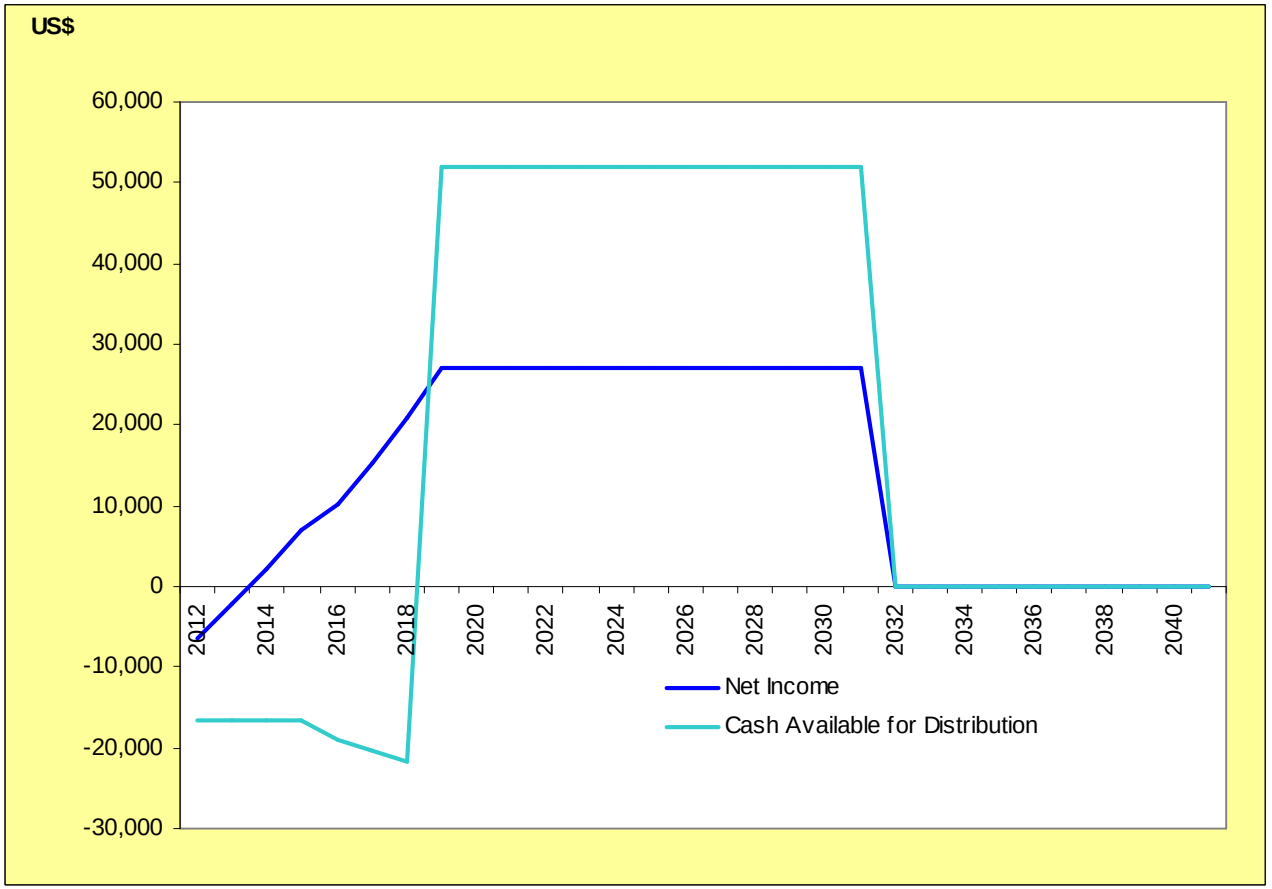
- **Site:**
  Gulf of Suez: Ras Sedr

- **Electricity Production Cost (Levelised):**
  6.51 $ct./kWh

Results – Net Income and Available Cash:

- **FIT = LEC**
- **RoE = 6.13 %**

➔ **Not able to service debt!**

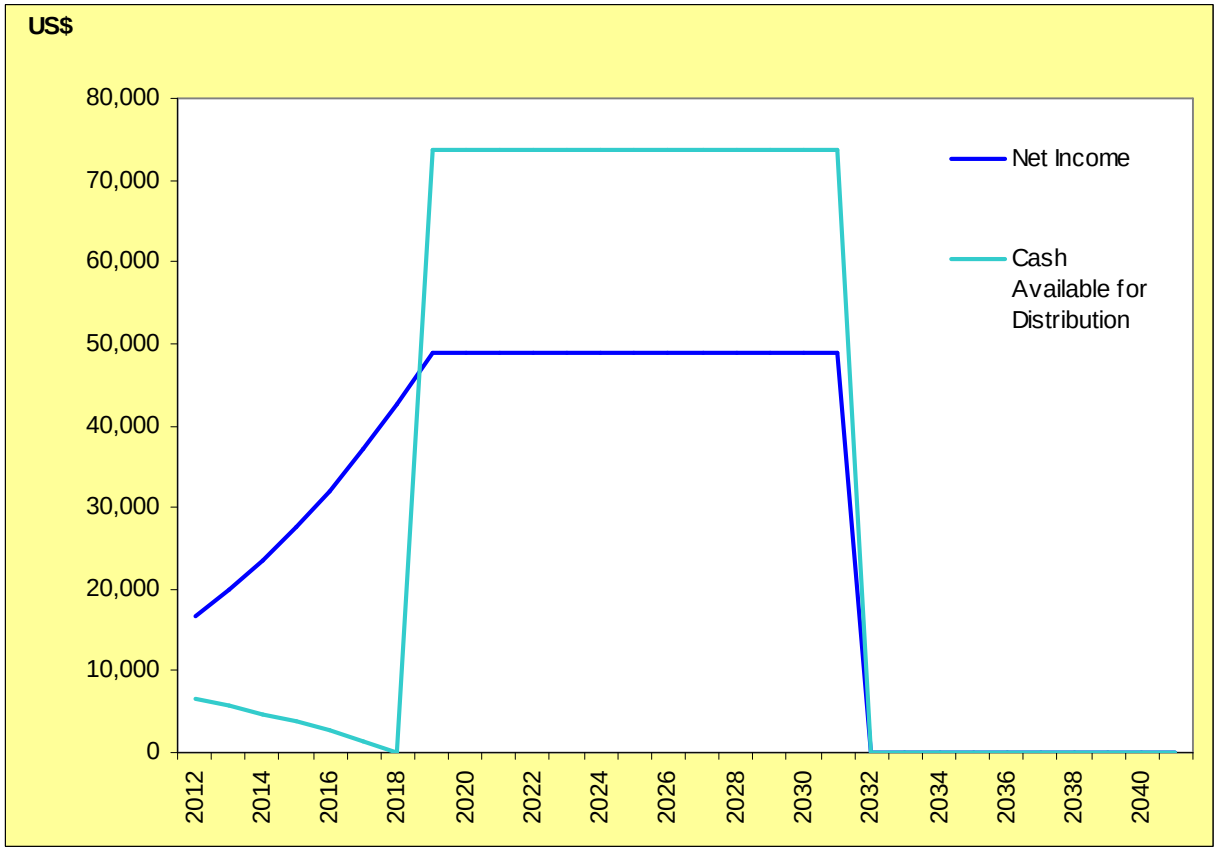


Results – Net Income and Available Cash:

- **FIT = 9.02 $ct./kWh**
- **RoE = 14.12 %**

But:

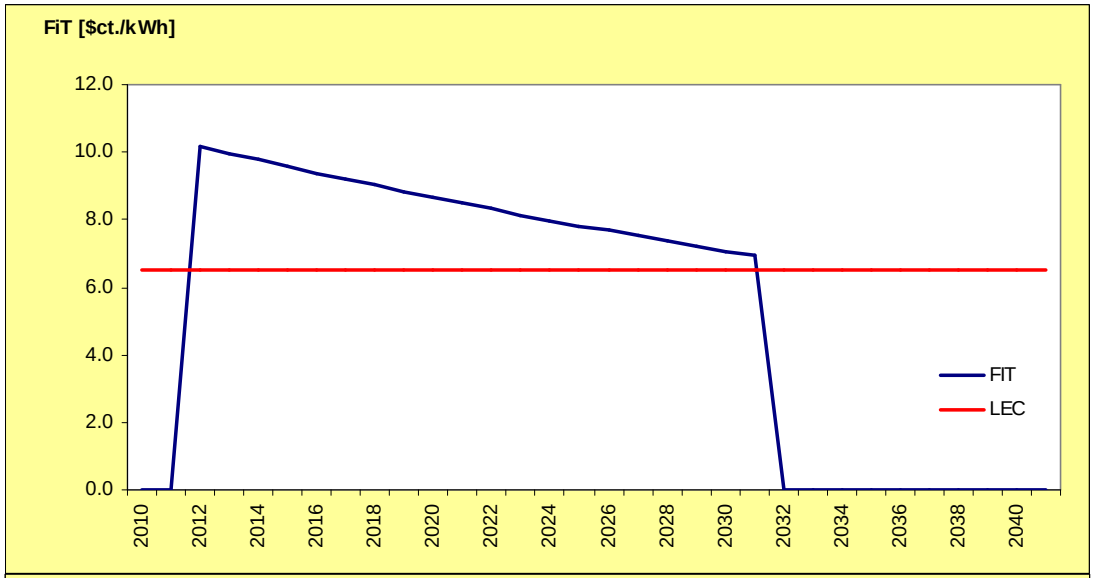
Permitted RoE: 12%

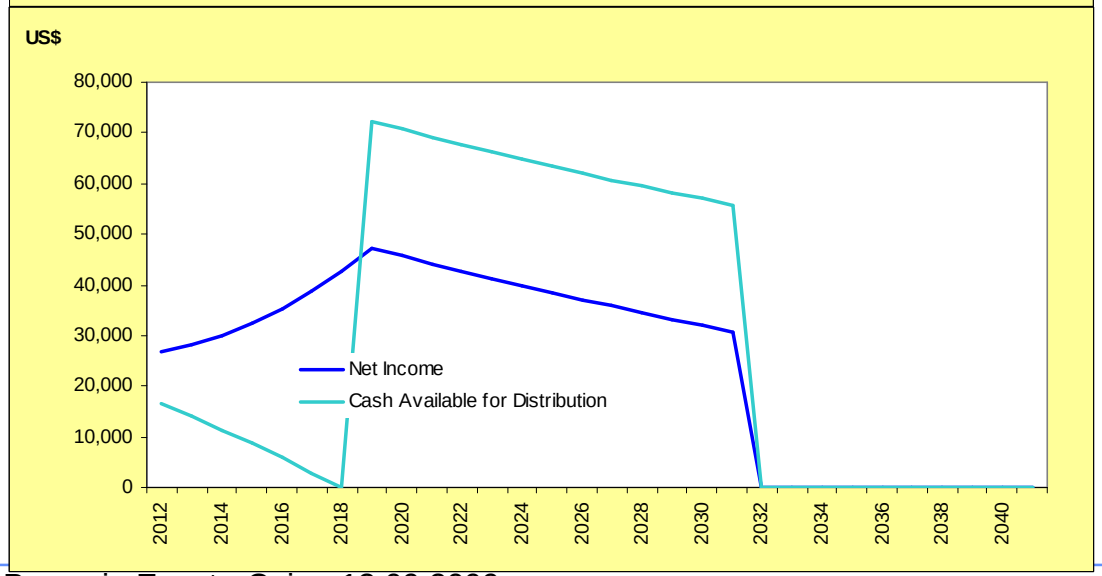


Results – Net Income and Available Cash:

- **Annual tariff reduction**
- **Initial FIT = 10.18 $ct./kWh annual reduction by 2% (maximum allowable)**

➔ **Able to service debt!**
➔ **But RoE = 14.64%**

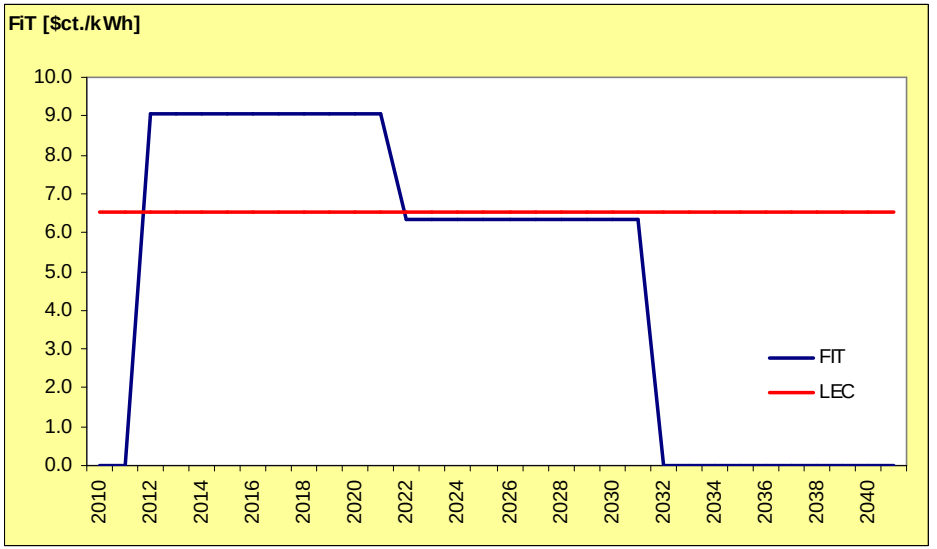


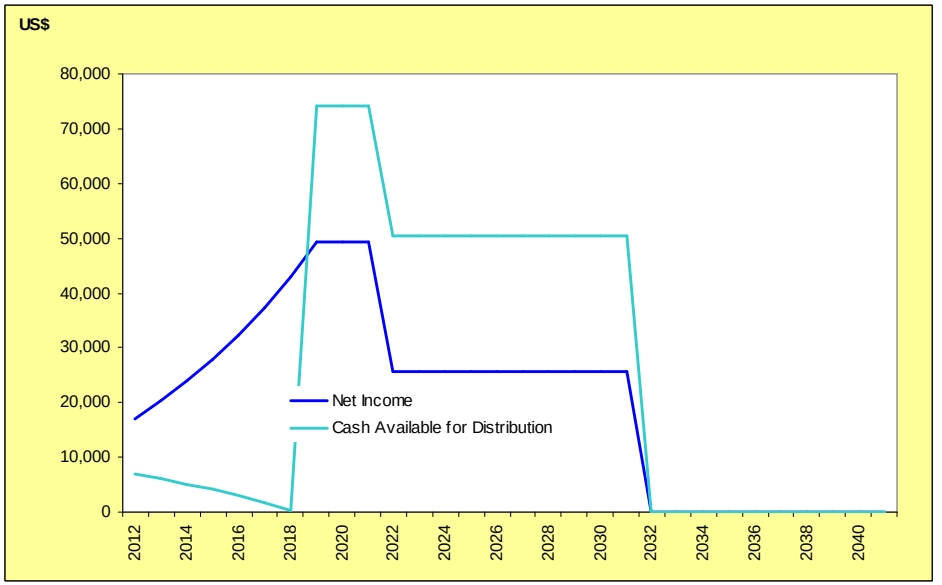


Results – Net Income and Available Cash:

- **Stepwise tariff reduction**
- **Initial FIT = 9.06 $ct./kWh reduction after 10 years by 30%**

➔ **Able to service debt!**
➔ **RoE = 12%**





Agenda IV:

I	FEED-IN TARIFFS – BACKGROUND & CONCEPTS
II	OPTIONS FOR FIT-DESIGN
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IV	**CONCLUSIONS & NEXT STEPS**

Conclusions I:

- **Eligibility:**
  - Limit Capacity as little as possible in order to fully exploit the potential of the feed-in tariffs
  - Do not limit production (if technically feasible)
  - No obliged share of local content or manufacturing

- **Payment terms:**
  - US$ as base currency
  - In case of proportionate payments → development of exchange rate scheme based on monthly production and exchange rate

Conclusions II:

- **Tariff scheme – Timeframe:**
  - Use 15 years for small installations (below ~150 kW) and longer periods for larger projects,
    but: Define on project basis!
  - Further discussion:

- **Tariff degression and diversion:**
  - Use inter-project tariff degression
  - Use intra-project tariff degression (First indications for stepwise tariff degression after 7-10 years)
  - Top-Down approach for technoloy- and site-specific diversion of tariffs

- **Institutionalise monitoring and adjustment of tariff scheme!!**

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