UNDP NAMA finance case study

Regional workshop on promoting international collaboration to facilitate preparation, submission and implementation of NAMAs

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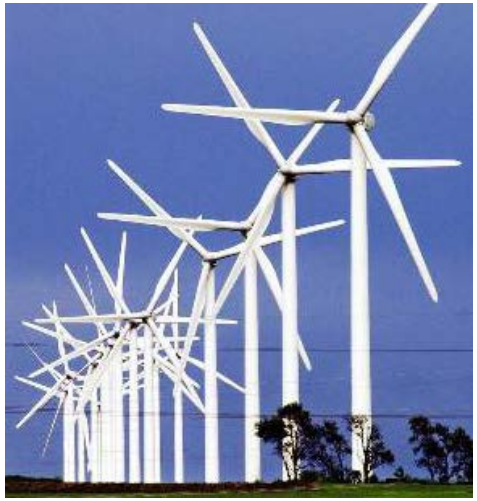
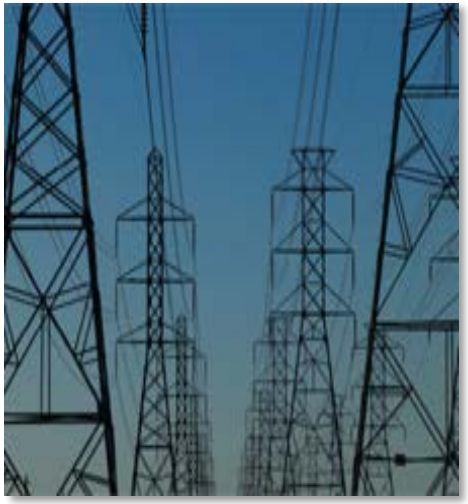



Aims and Agenda

Aims

- Design two alternative NAMAs that both have the objective to attract private investment into 500MW of on-shore wind energy
- Compare both NAMAs in terms of their costs and effects

Agenda

1. The concept of LCOE
2. Introduction to the UNDP DREI tool
3. Case study
    1. Step 1: Modelling the Baseline
    2. Step2: Designing the cornerstone instrument NAMA
    3. Step 3: Designing the instrument package NAMA
    4. Step 4: Comparing both NAMAs
4. Discussion

1. LCOE – concept and formula (1)

- LCOE stands for "Levelized Cost of Electricity"
- LCOE is represents the cost per unit of energy (e.g., in USD/MWh)
- LCOE divide the discounted cost over the life cycle of a plant by the discounted energy output over the lifetime

$$LCOE = \frac{\sum_{t=1}^{n} \frac{Expenditures_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{Electricity\ generated_t}{(1+i)^t}}$$

n: $lifetime$

t: $year$

i: $Discount\ rate$

- Thereby the LCOE represents the constant unit cost over the entire life cycle of a plant (i.e., lifecycle costs)
- If a plant owner is remunerated the LCOE, the plant operates exactly at the profitability threshold (NPV=0)

⇒ LCOE is a good concept to calculate Feed-in tariffs (a FIT should provide the LCOE and potentially a premium)

⇒ LCOE is a good indicator to compare technologies (even with different life times)

⇒ Commonly used by policy makers, planners, researchers and investors

1. LCOE – concept and formula (2)

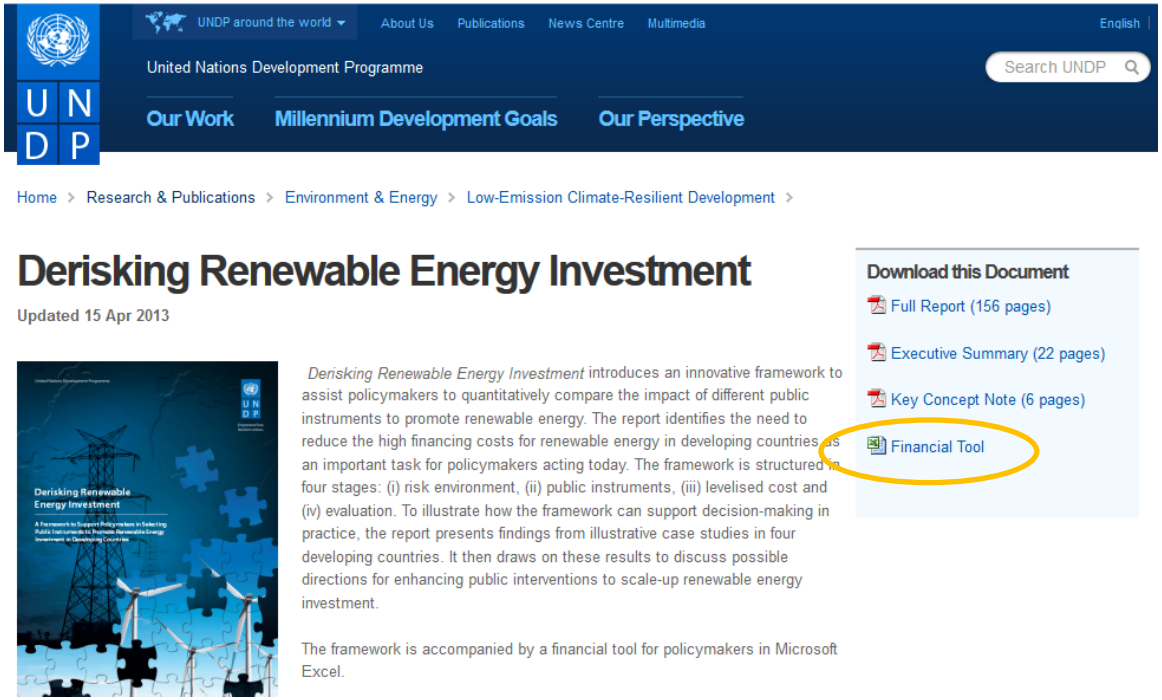
- The discount rate in LCOE represents the financing costs
- In the model we use an equity perspective, hence the formula is more complicated

$$\frac{\%\ \text{Equity Capital} * \text{Total Investment} + \sum_{t=1}^{T} \frac{(O\&M\ Expense)_t + (Debt\ Financing\ Costs)_t - Tax\ Rate * (Interest\ Expense_t + \text{Depreciation}_t + O\&M\ Expense_t)}{(1 + Cost\ of\ \text{Equity})^t}}{\sum_{t=1}^{T} \frac{Electricity\ Production_t * (1 - Tax\ Rate)}{(1 + Cost\ of\ \text{Equity})^t}}$$

Where,
% Equity Capital = portion of the investment funded by equity investors
O&M Expense = operations and maintenance expenses
Debt Financing Costs = interest & principal payments on debt
Depreciation = depreciation on fixed assets
Cost of Equity = after-tax target equity IRR

2. UNDP DREI tool

- Excel-based tool to compare the effects and costs of different policy designs to support renewable energy technologies (on-shore wind power)
- Freely downloadable from **www.undp.org/DREI**



Let's have a look at the tool

- The model we use in this exercise has been slightly adjusted from the downloadable version

3. Case study – Introduction

- You as a team are asked to assist Country X in designing a NAMA
- Electricity shortages, state-owned Electricity Supply Company (ESC) not in good state
- As there are good wind resources, the idea is to design a NAMA that attracts private sector investments into 500MW of on-shore wind power
- An important topic is to use scarce public resources effectively and efficiently
- Two alternative designs will be developed:
  - *A cornerstone-instrument only NAMA*
  - *A public instrument package NAMA*
- Both NAMAs shall be designed and compared regarding costs and effects
- We will use the DREI tool and proceed in 4 steps

3. Case study – Step 1: Modelling the baseline

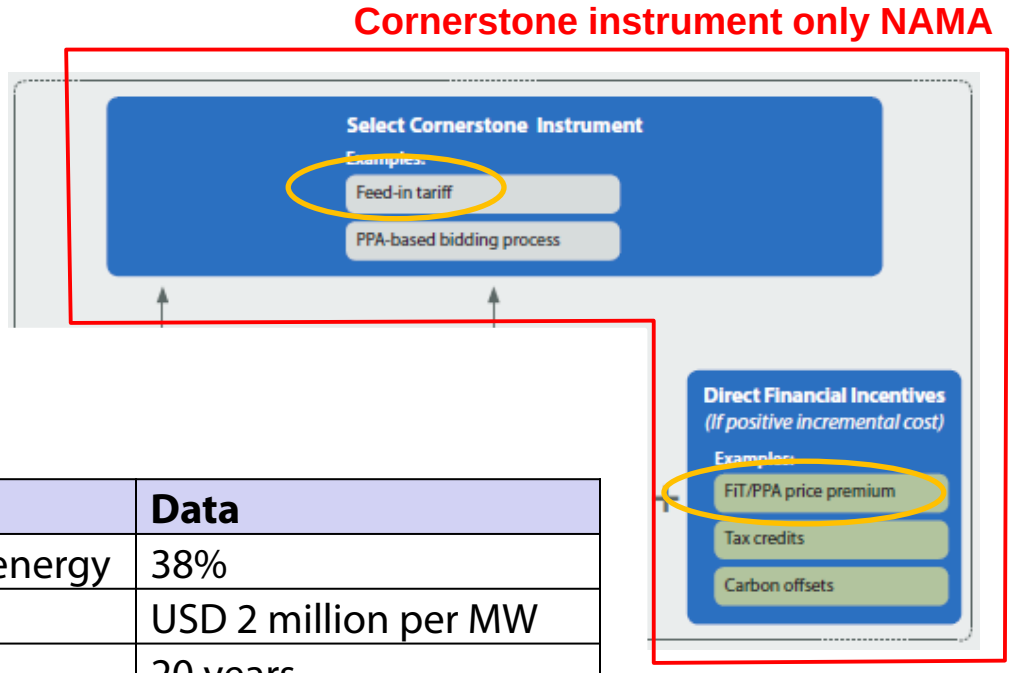
- In order to design and compare NAMAs, a good starting point is to analyze the baseline and model its costs
- In the DREI tool please use the "II. Inputs, Baseline Energy Mix" tab and enter the data from the table to the right into the respetive yellow cells

Please proceed in Excel and enter the numbers

Input	Data
Current baseline energy generation mix	Hydro: 75% Biomass: 10% Diesel: 15%
Marginal baseline energy generation mix As a percentage:	 Hydro: 69% Diesel: 31%
Most recent 5 private sector investments in new generation:	800MW Hydro (4.4 TWh/year) 15 MW Diesel (0.1 TWh/year) 100 MW Diesel (0.6 TWh/year) 50 MW Diesel (0.3 TWh/year) 150 MW Diesel (0.9 TWh/year)
Emission factors	
Individual grid emission factors:	Hydro: 0.000 tCO2/Mwhel Diesel: 0.700 tCO2/Mwhel
Total marginal baseline grid emission factor:	0.212 tCO2/Mwhel

3. Case study – Step 2: Designing the cornerstone instrument only NAMA

- Please design a NAMA in which you pick one cornerstone instrument:
  a feed-in tariff for wind
- In the DREI tool please use the "III. Inputs, Wind Energy" tab and enter the below data into the respective yellow cells
- Specifically refer to the "Cornerstone-only NAMA" columns

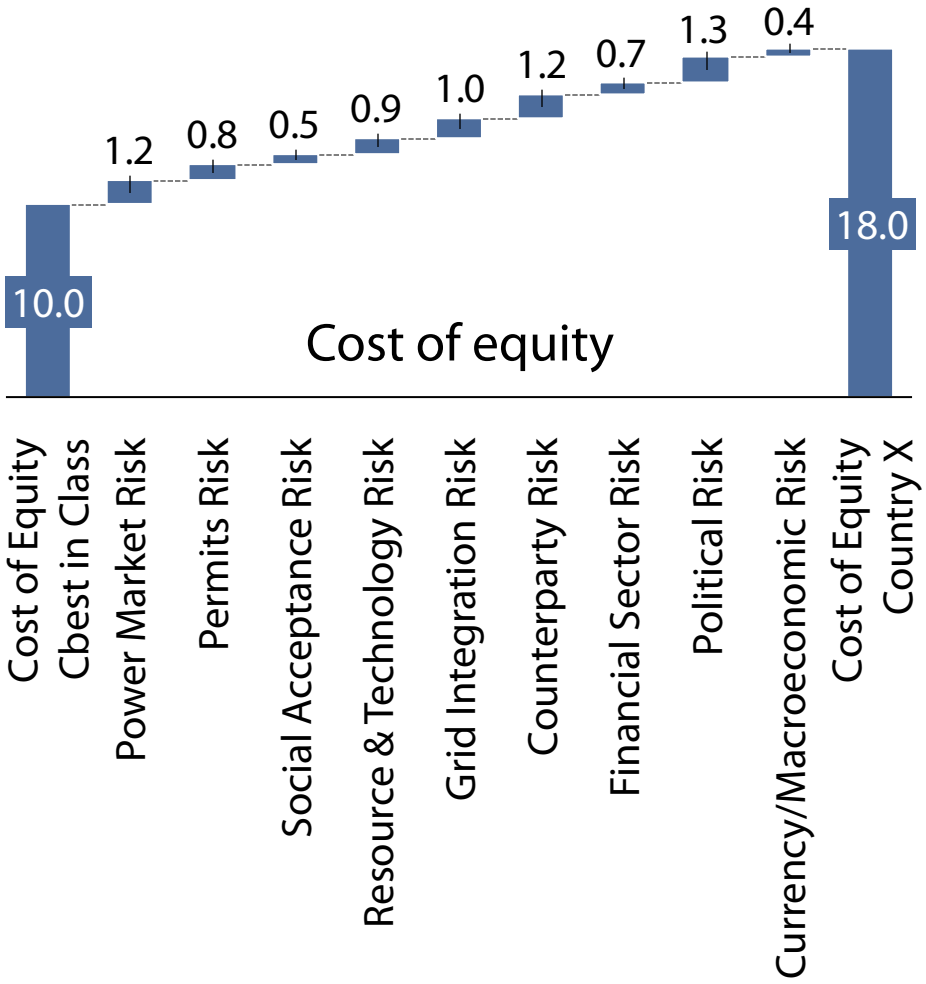


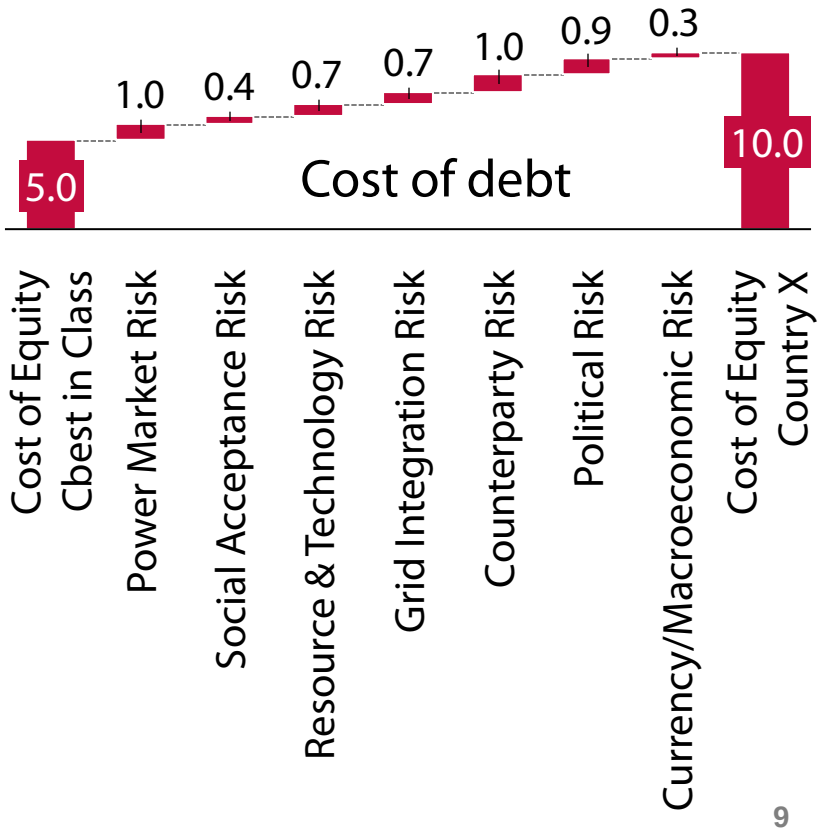
Input	Data
Estimated capacity factor for 500MW of wind energy	38%
Investment costs	USD 2 million per MW
Life expectancy of assets	20 years
Cost of equity	18%
Cost of debt	10%
Capital structure	70% debt/30% equity
Loan tenor	12 years
Corporate tax rate (effective)	25%
Administrative costs of the FiT over 20 years	USD 1.7 million

Please proceed in Excel and enter the numbers

3. Case study – Step 3: The risk environment in Country X

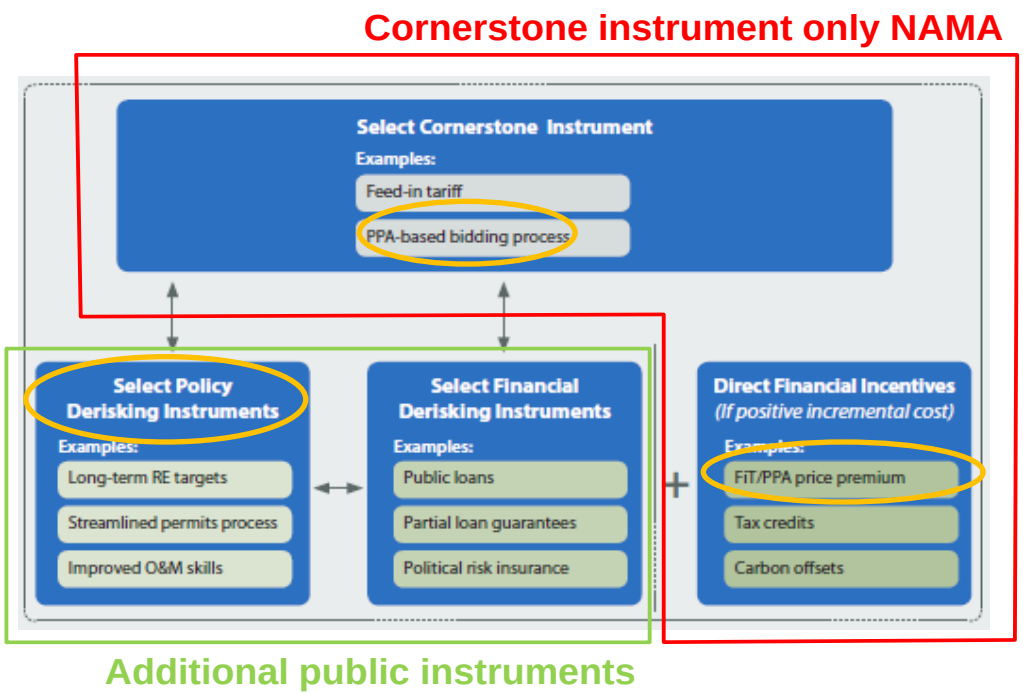
- The investment environment of Country X suffers from many risks
- These drive the financing costs (see below)





3. Case study – Step 3: Designing the public instrument package NAMA

- Please design a NAMA in which you select public instruments which complement the cornerstone instrument (FiT for wind)
- In the DREI tool please use the "III. Inputs, Wind Energy" tab and enter the below data into the yellow cells
- Specifically refer to the "Instrument package NAMA" columns



Risk Category	Estimated Cost
Power Market Risk	$1'100'000 (above the administrative costs of the FiT)
Permits Risk	$1'000'000
Social Acceptance Risk	$500'000
Resource & Technology Risk	$1200000
Grid Integration Risk	$1'500'000
Counterparty Risk	$1'800'000
Financial Sector Risk	$800'000

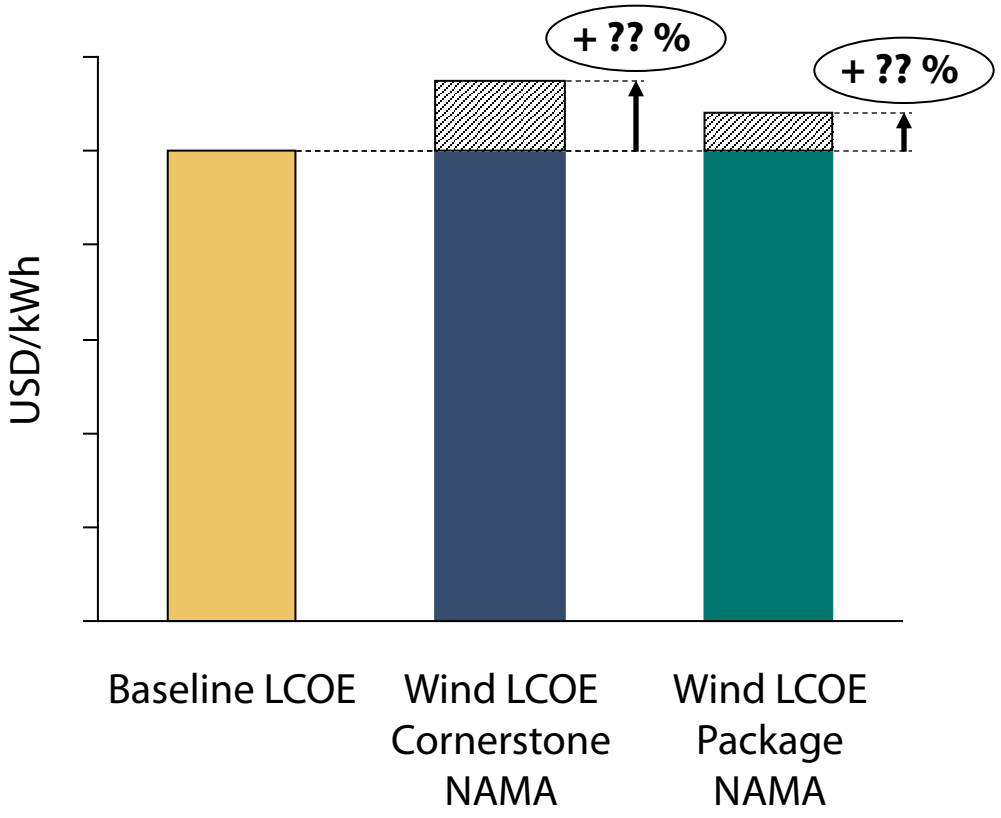
Please proceed in Excel and enter the numbers

3. Case study – Step 4: Compare the two alternative NAMA designs

Question 4.1:

- How do the on-shore wind LCOE differ between the two NAMA designs?
- And how do the incremental costs (i.e., the additional costs of wind over the baseline) differ?
- What does this imply for the affordability of electricity for the end consumer in Country X?

LCOE and incremental costs



3. Case study – Step 4: Compare the two alternative NAMA designs

Question 4.2:

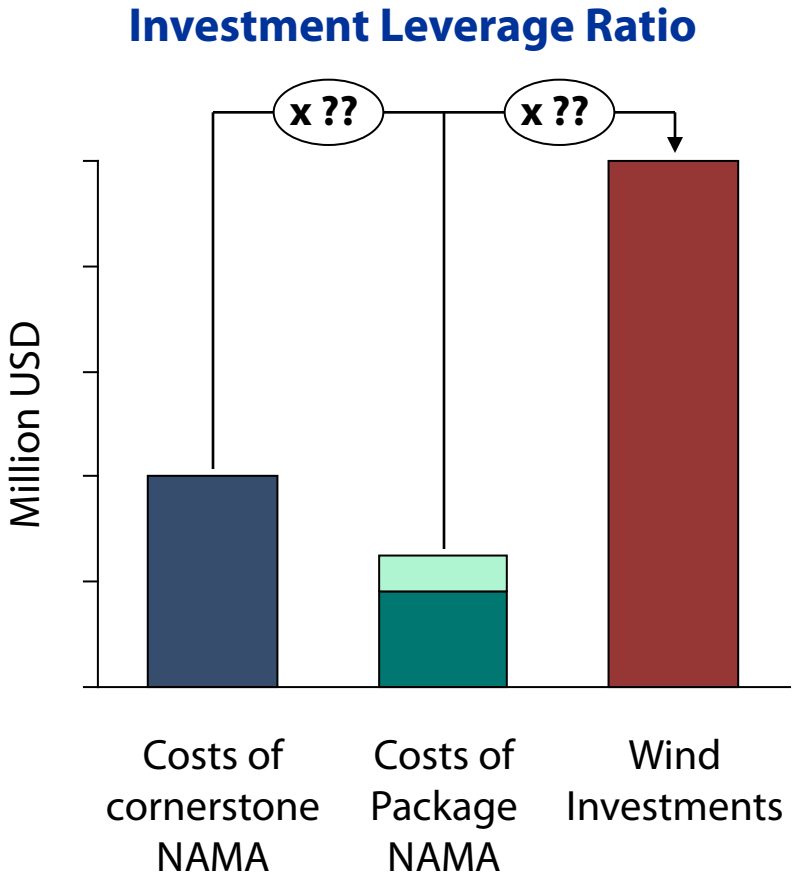
- How much private sector investment will the NAMAs trigger?

Question 4.3:

- What are the total public costs of the two alternative NAMAs?
- What is the breakdown between policy derisking instrument costs and incremental cost (FIT premium)?

Question 4.4:

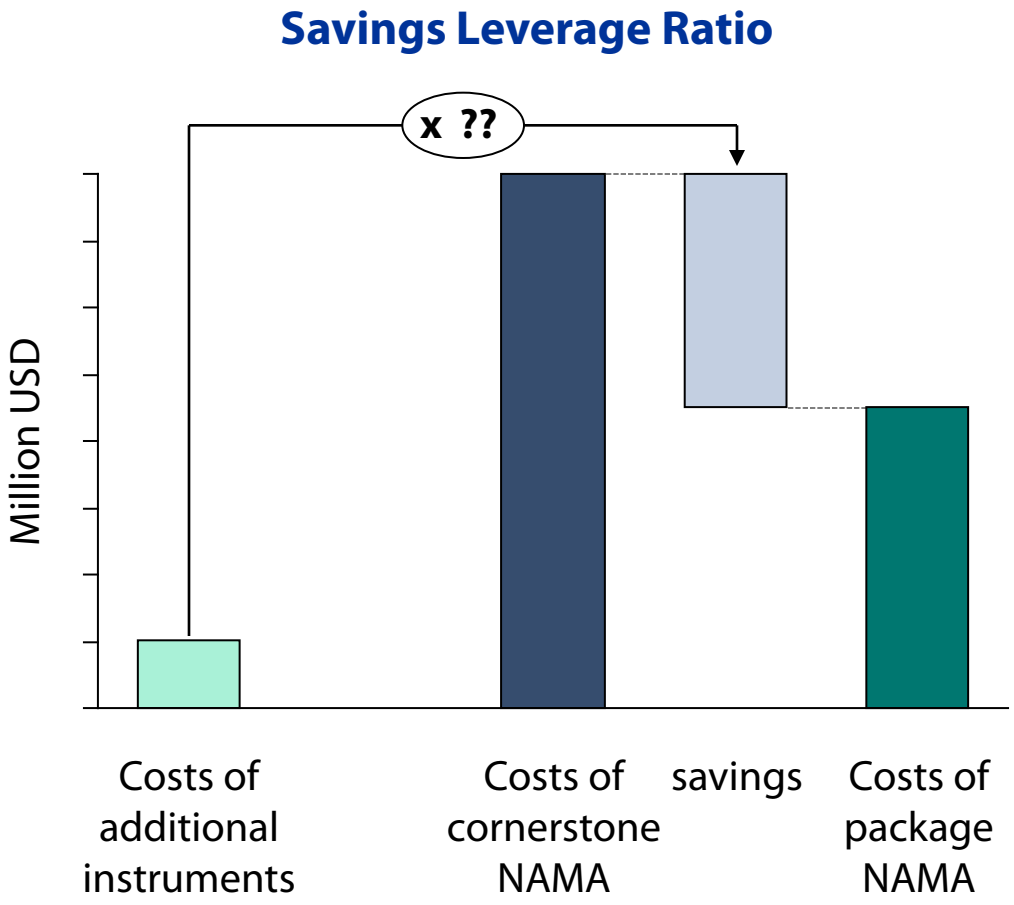
- How does the investment leverage ratio compare between the two alternative NAMAs?
- What is the main public cost component that drives the investment leverage ratio in Country X?



3. Case study – Step 4: Compare the two alternative NAMA designs

Question 4.5:

- What is the savings leverage ratio of the additional instruments in the public instrument package NAMA?



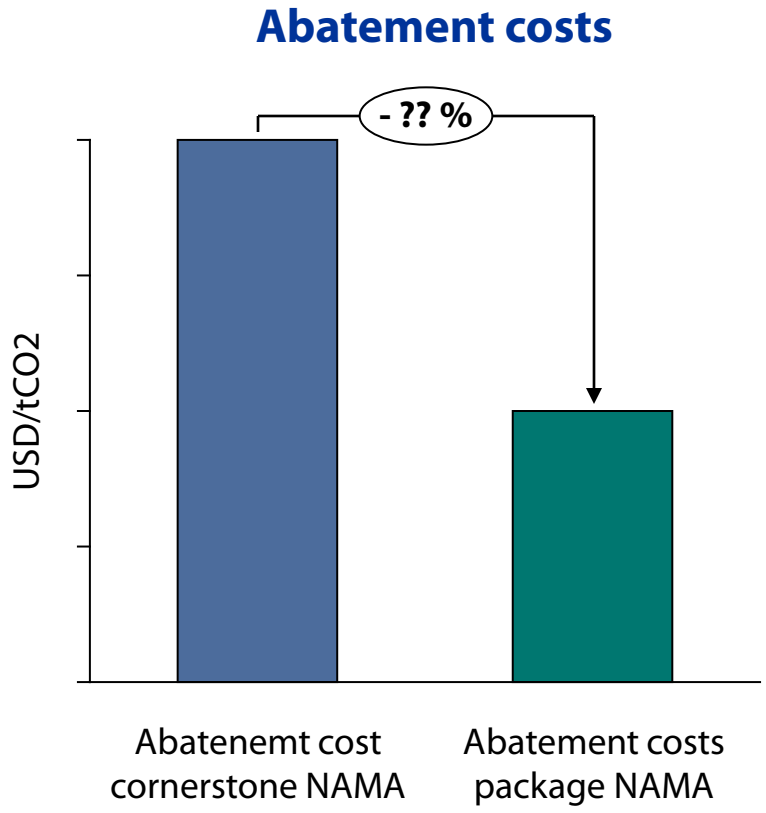
3. Case study – Step 4: Compare the two alternative NAMA designs

Question 4.6:

- Over the 20 year lifetime, what are estimated emission reductions that result from the wind energy investment in the NAMAs?

Question 4.7:

- What are the carbon abatement costs of both NAMAs?



4. Discussion Questions

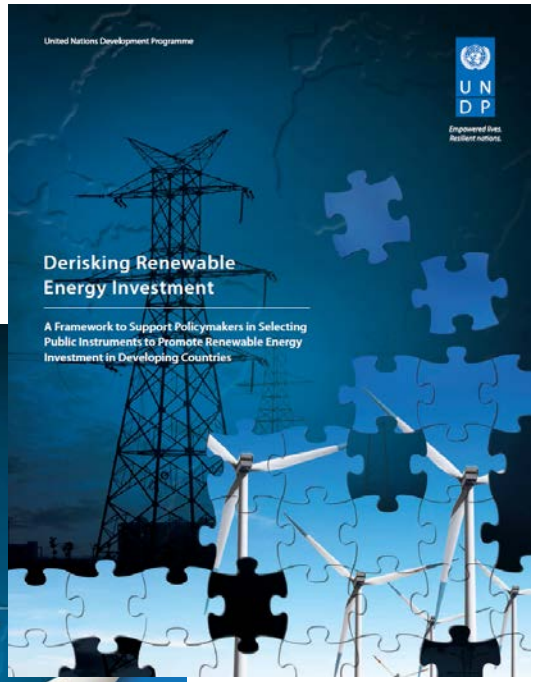
D1: Funding the NAMA

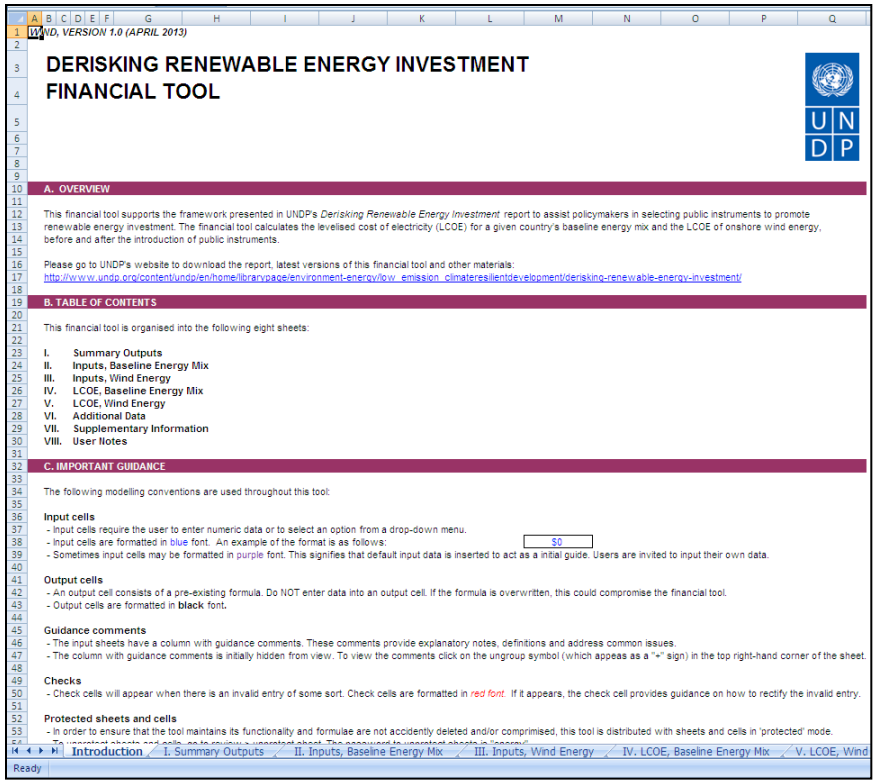
- Who among the main actors (national government, private sector, international donors, etc) could fund the various components in the proposed NAMA designs?
- Which instruments are well suited for MRV, which are less?

D2: The role of fossil fuel subsidies.

- What are the impacts of a 20% diesel fuel subsidy on the costs of both NAMAs?

Reports & Financial Tool





Available at www.undp.org/DREI