



PPSDM Jakarta, October 30th, 2017

## Company decision-making for geothermal projects (GEOCAP course 1.07)

### Topic: Geothermal asset life-cycle and project maturation

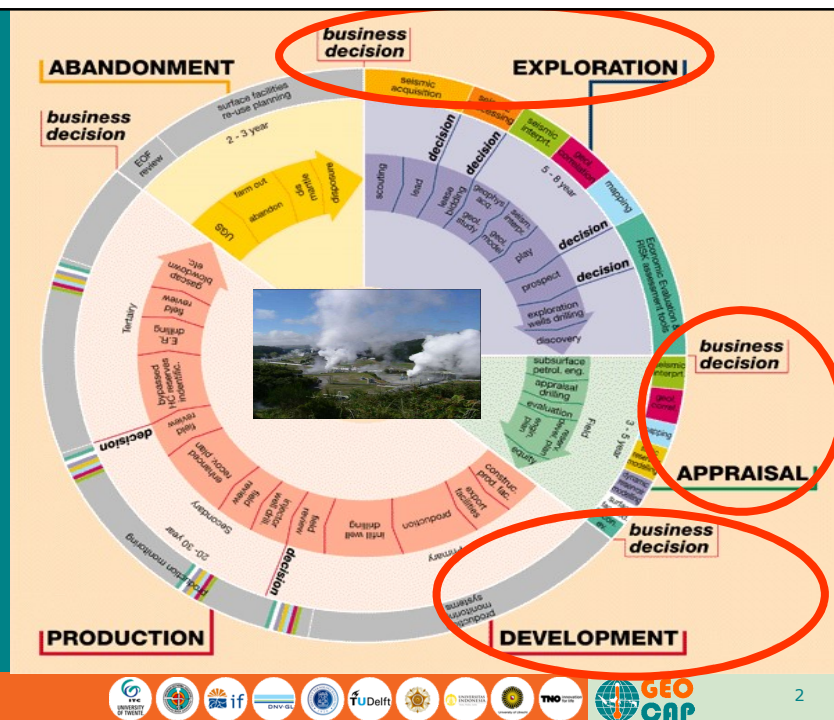
Lecturer - Ir. Christian Bos

Public document (GEOCAP-2016-REP-TNO-1.07-xx)

## Geothermal Asset Lifecycle

- 5 main phases
  - + 6<sup>th</sup>: Monitoring
- Many major decisions:
  - Inter-phase
- And minor decisions:
  - Intra-phase

GT Asset is depletable in economic terms, i.e. non-renewable.  
ABD decision based on increasing Opex vs. declining revenues (30 yrs?)



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# GT asset life-cycle phases

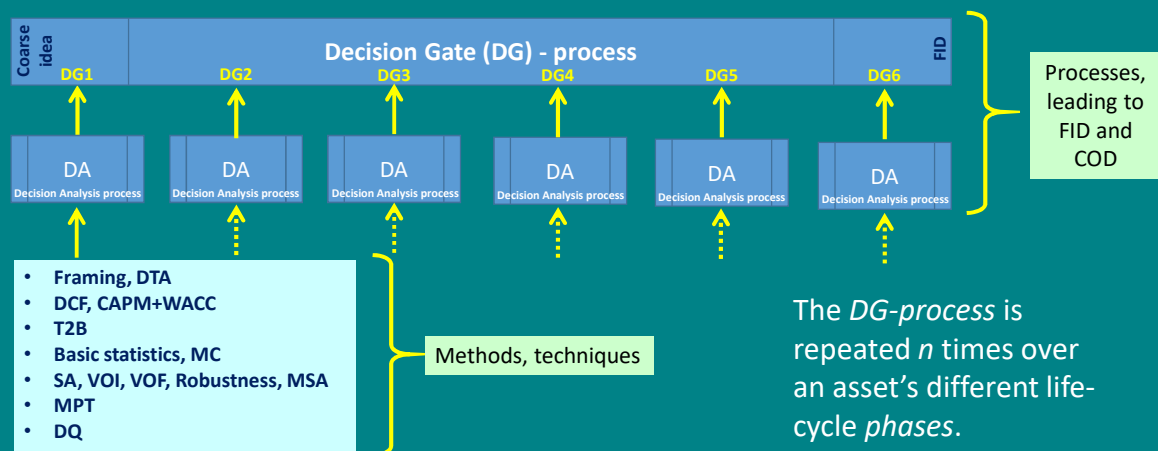
- 'Preliminary survey' (pre-phase): *Govt site selection + inviting exploration bids*, leading to
- Operator DG '**Exploration license application**', followed by *Operator/Govt negotiations* + if successful:
  - Govt DG '**Exploration license granting**'
1. Exploration, if promising leading to
    - Operator DG '**Appraisal work programme**' (or directly to DG '**Conceptual engineering**').
  2. Appraisal, leading to
    - Operator DG '**Conceptual engineering**' (or FEED: Front-End Engineering & Design),
    - Operator DG '**Concept selection**' and
    - Operator DG '**Production license application**' + Govt DG '**PDO sanction**'
      - Leading to Operator DG '**FID**' (**Final Investment Decision**)
  3. Development
    - a) EPC activity (Detailed Engineering – Procurement – Contracting)
    - b) Construction activity (leading to DG '**Commissioning**' and '**COD**')
  4. Operation (production operations & maintenance / exploitation)
    - Direct or indirect utilization (condition of license)
    - Including Operator DG's for '**Incremental development(s)**'
  5. Decommissioning (joint Operator and Govt decision)
    - Dismantling surface installations + abandoning wells (+ prepare for mandatory monitoring)

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## Company decision-support processes & methods



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# Asset life-cycle Decisions: Govt. vs. Operator

Mapping main *contingent* Activities and Decisions for Govt and Operator

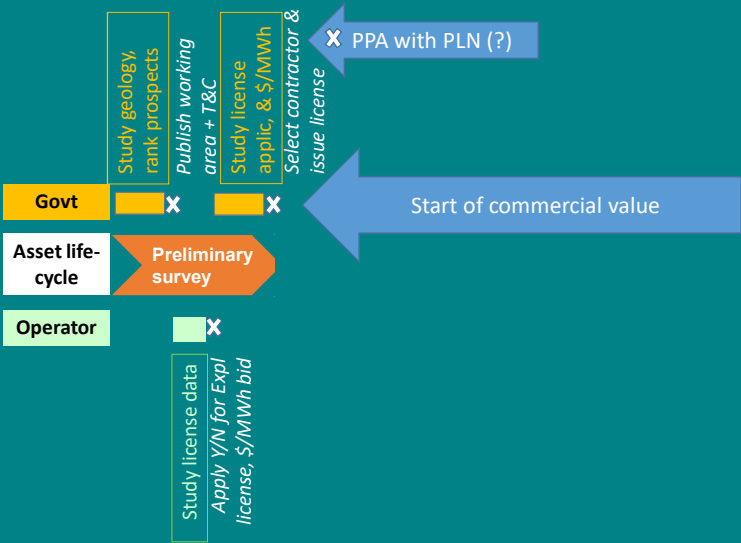
- Govt
- Asset life-cycle
- Operator

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# Asset life-cycle Decisions: Govt. vs. Operator

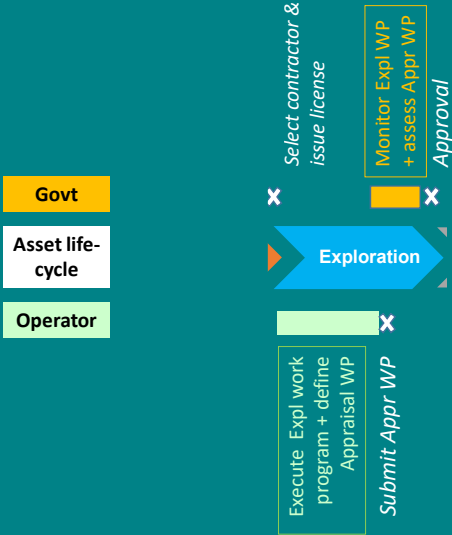


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# Asset life-cycle Decisions: Govt. vs. Operator

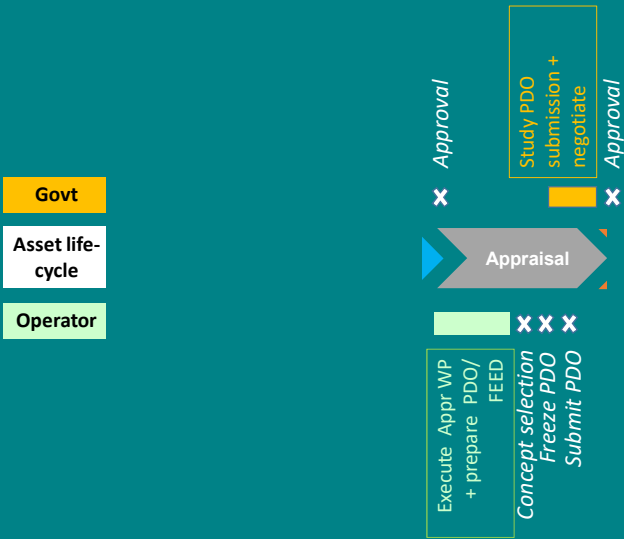


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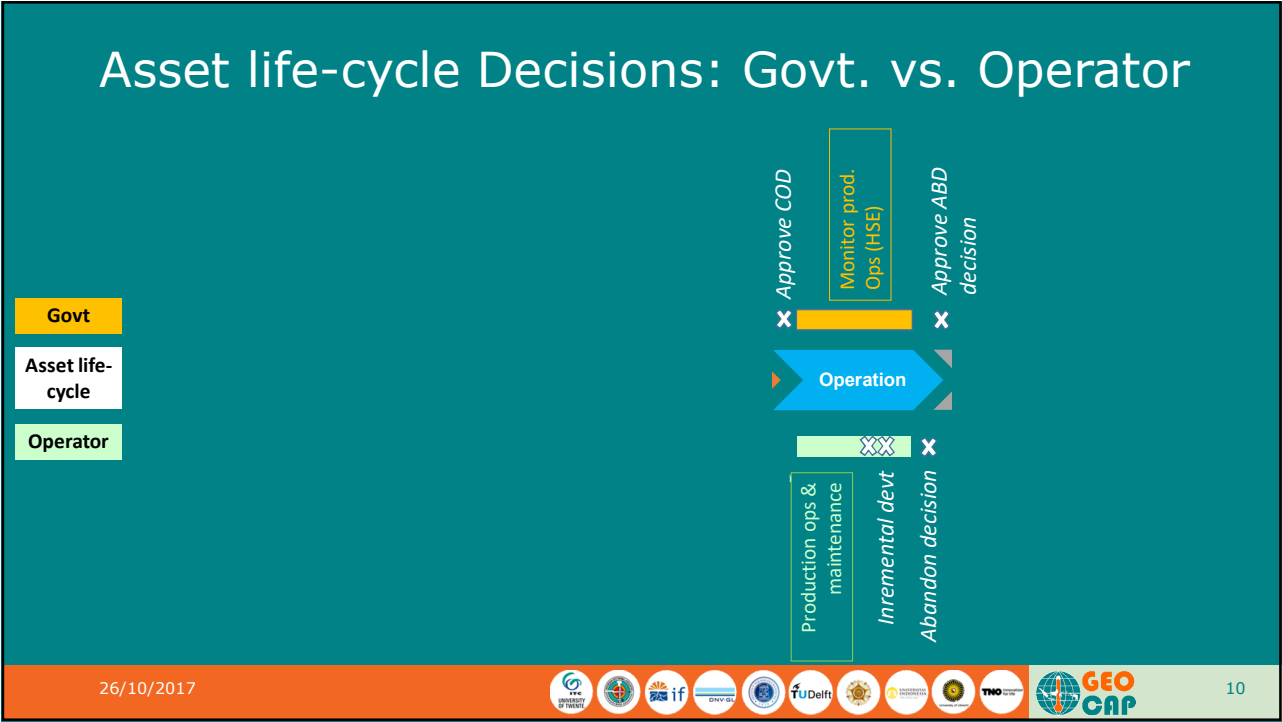
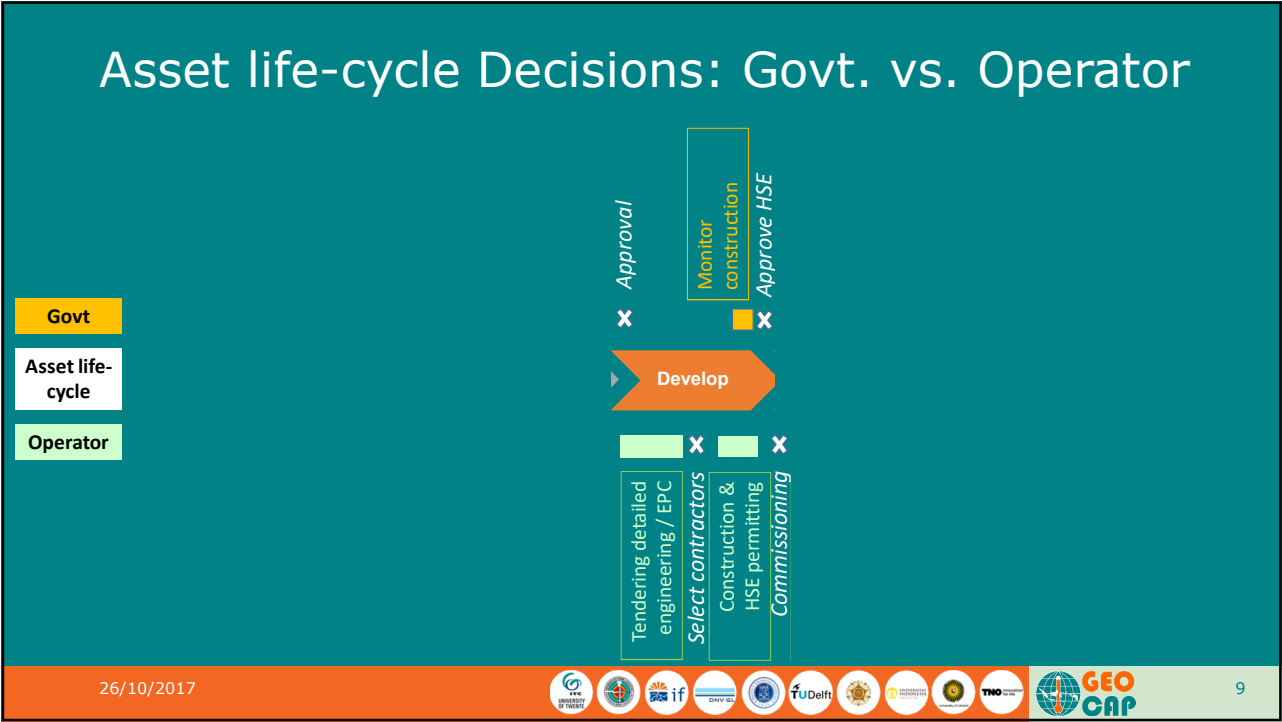
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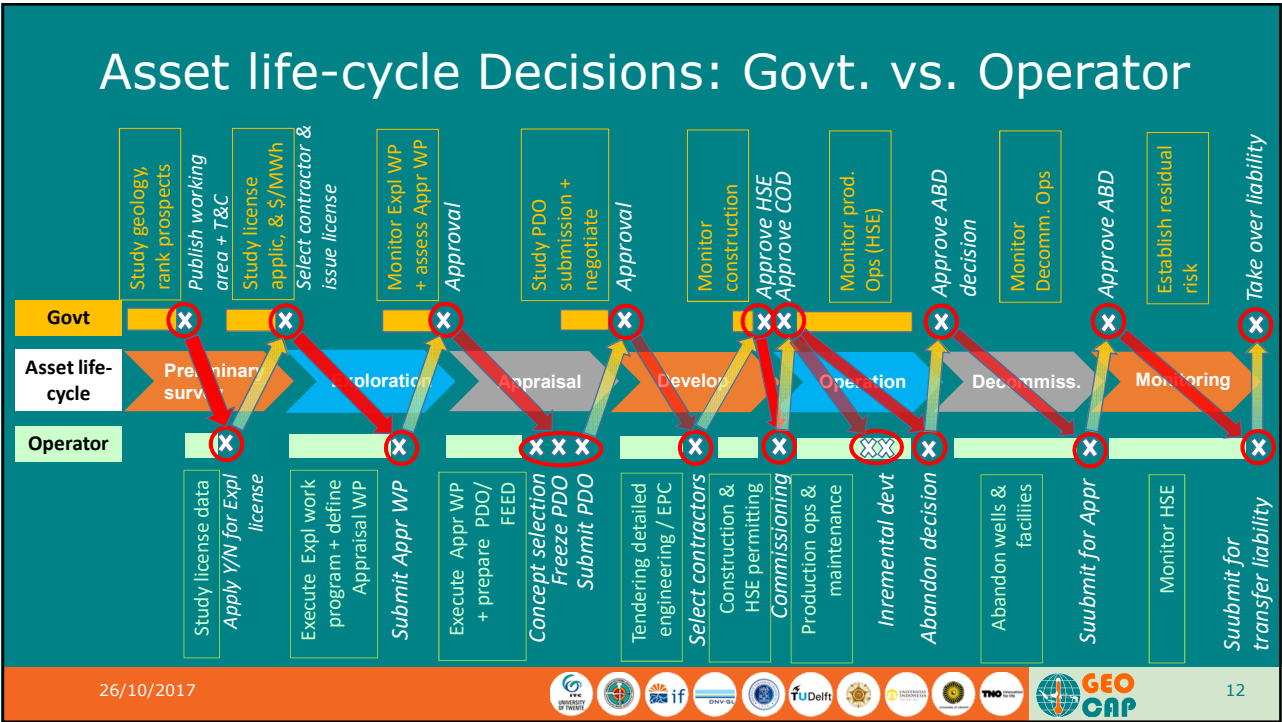
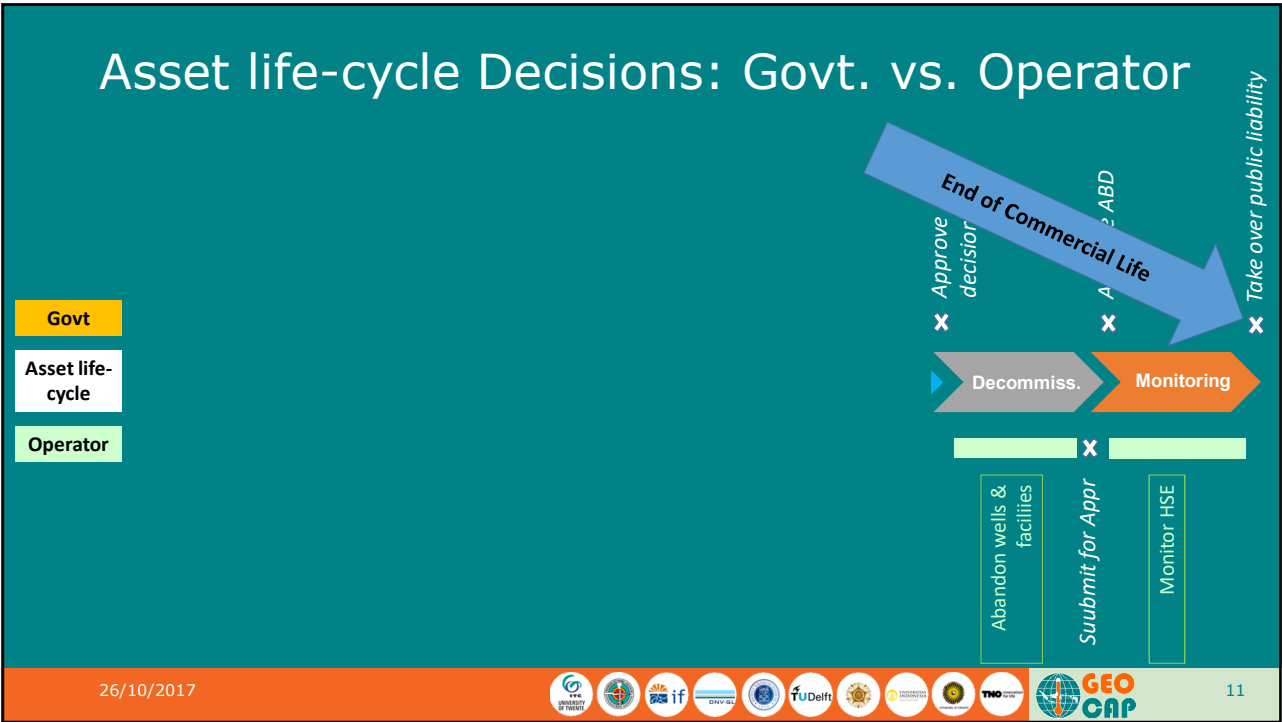


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# New Geothermal Law Indonesia

- Target
  - Increase GT capacity from 1.4 GW (2015, from ca 300 locations) to 3.2 GW (2020)
  - And in 2025, capacity should be 5.0/6.5/9.5 GW (unofficial estimates)
  - New GT law should stimulate this
- Some characteristics of new GT Law
  - GT is no longer a mining activity, i.e. no royalty on depletable resource, environmentally less constrained
  - 2 types of licenses: indirect and direct utilization (indirect : conversion to e)
  - If indirect license, PLN must construct a transmission line
  - PLN must prepare a PPA – Power Purchase Agreement
  - Feed-in tariff is geographically determined
  - Various barriers have been removed (ref. previous GT law): GT in forests, bureaucracy
  - Tendering process (license bidding) still to be formalized
  - Authorities assess the financial capabilities and work programme of the bidder
  - GFF = Geothermal Fund Facility to promote GT exploration
- Some concerns on new GT law
  - There are potential conflicts with other energy laws in Indonesia:
    - Overlapping permits with other activities (land conflicts, access roads)
  - In case of bank loans, operators have difficulty in providing adequate collateral
  - Public acceptance (nimby) is often a problem

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# Government GT decision-making

Action / Milestone Decision by Government	Required information / knowledge by Govt
1. Prioritize open GT-acreage	Regional information on geology, and experience with nearby GT-fields
2. Publish license bidding round	Terms and conditions that will apply to new GT field operators, description of geology and market.
3. Evaluate Exploration license bids by operators	Operator Exploration Work Program, including conceptual PDO (Plan for Development and Operation) and proposed tariff/MWh
4. Prioritize Exploration license bids by operators	Govt policy on which KPIs to consider and how. Understanding of how these KPIs have been established by the operator and how to interpret them. Understanding the risks in the forecast Govt Take.
5. Enter further negotiations & select Operator for Exploration work program	Establish details of Exploration license agreement
6. Evaluate PDO submission + grant GT Production license	In case of Exploration discovery, assess PDO submission + impact of detailed T&C on Govt Take and on govt GT-policy
7. Monitor operator's execution of field devt, establish COD	Data & info from field as supplied by operator, fiscalized volumes as obtained from other authorities (tax, regulator, etc.)
8. Influence operator's updating of PDO as new info is being revealed in time. Eventually: Abd decision	Info & know-how on operations, on cash-flows and on impact on general GT policy. For Abandonment decision, Govt needs to understand remaining potential of field.

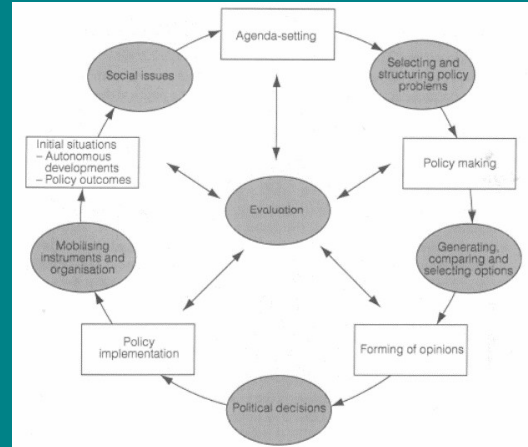
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## Government policy cycle

- Government policy measures aim at striking a balance between creating a good investment climate and meeting the country's need.
- Policy measures need to be designed and assessed ex-ante, using clear criteria.
- After implementation, policy measures need to be assessed ex-post, using original criteria.
- If necessary, policy measures need to be finetuned / updated.
  - Establish formal learning process!



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## Govt KPIs for assessing *exploration* license applications

- Information / knowledge obtained as a result of the **Exploration Work Program** submitted, to the effect it may help further regional exploration
- Competence / track record of company in terms of exploration successes
- Financial capability of company (competence/track record)
- HSE&SR impact analysis of Exploration Work Program
- HSE&SR competence / track record of company

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## Govt KPIs for assessing *production* license applications (some examples)

- MW capacity installed + timing
- MWh tariff of electricity sold to PLN
- Expected GWh to be produced per year + uncertainty
- Track record and financial capability of Operator
- Yearly expected cash flow from Govt Take (corporate tax mainly) + uncertainty around this expectation
  - Incl. risk of losing tax income from other assets (if not ring-fenced)!
- HSE&SR impact analysis of PDO
- Information / knowledge obtained as a result of the project, which may help future projects meeting the companies' hurdle rates
- Information / knowledge obtained as a result of the project, which may help the government to negotiate better T&C of new projects

Learning

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## Company Decision Gate process (Statoil)

- Project maturation from brainwave to bankability to FID
  - **DG1 - Approval of Project Initiation**
    - Validate basis to pursue the business opportunity, initiate the project
  - **DG2 - Approval of Concept Short List**
    - To confirm that *resolution of uncertainties* supports continuation of project definition and move to Concept selection. Has the project been effectively framed and is there a sufficient knowledge to start the process of *selecting* the concept and defining the plan?
  - **DG3 - Approval of Main Concept**
    - To confirm approval of the Concept Selection
  - **DG4 - Approval to issue PDO (Plan for Development and Operation)**
    - Project considered sound & ready to execute, prior to & conditional on PDO approval
  - **DG5 - Approval to Start Execution**
    - To confirm that the conditions as at DG4 are still valid
  - **DG6 - Approval to Start Operation**
    - To confirm ready to start operation and hand over of Operator ship
  - **DG7 - Post Implementation Assessment**
    - To assess to what degree the objectives of the development project have been fulfilled
    - To assess whether Operations are being undertaken in accordance with requirements
    - To provide experience feedback for future projects

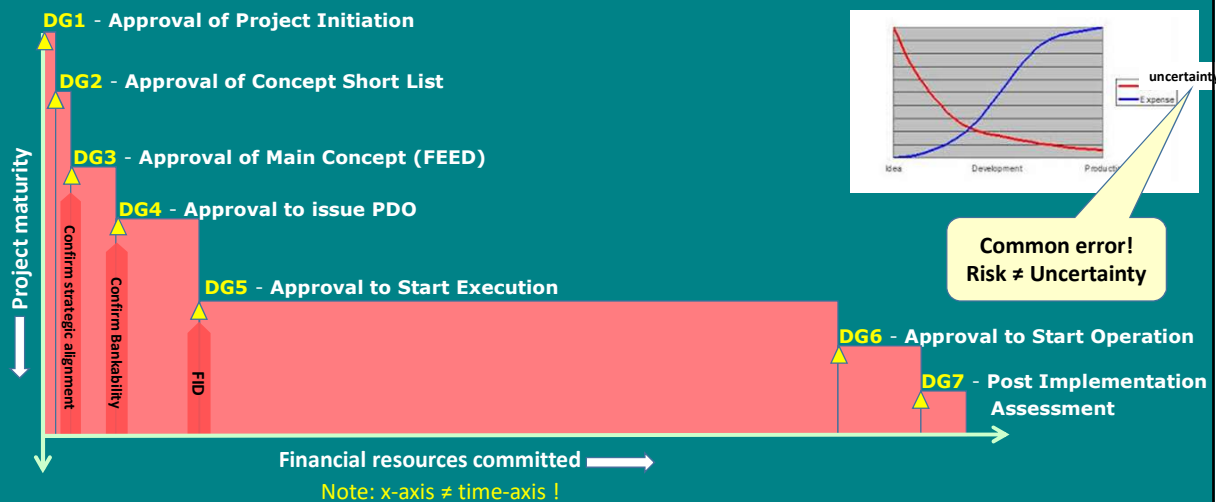


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## Decision Gates vs. financial commitment



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## Bankability

- Commercial banks vs. development banks
  - Less control by bank / higher costs vs. More control / lower costs
- Corporate financing (balance sheet): equity vs. loan
- Project financing (collateral = project)
- World Bank criteria: "due diligence". This includes many steps, e.g.
  - Approved project implementation plan, responsibilities of parent company with respect to subsidiary company receiving and managing the loan, interest rate + debt repayment schedule, company solvency, tendering process, accountancy standards + financial monitoring plan, HSSE&SR safeguards, dispute settlement, etc.
  - Consistency with WB's Country Partnership Strategy and overall WB objectives
  - And many other!

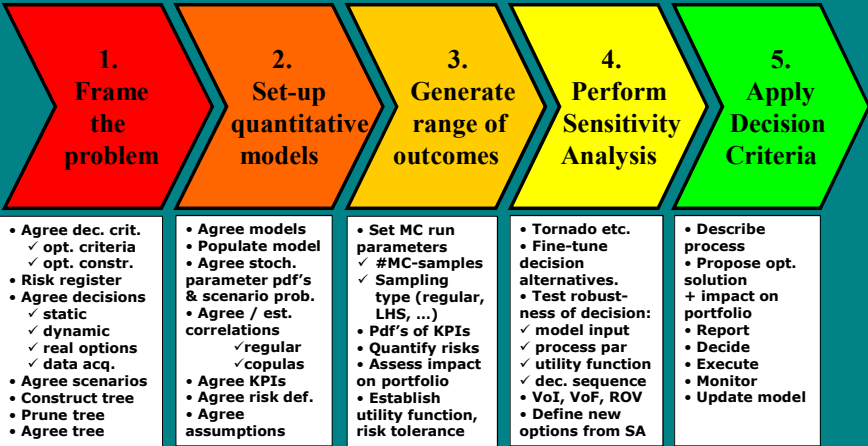
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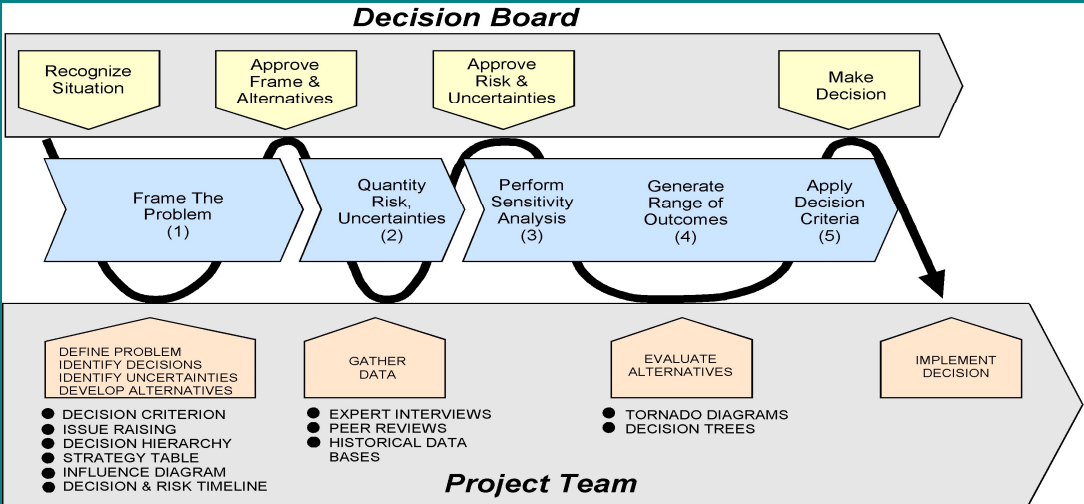
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# Decision Analysis process (1)

• DA process is to be updated at various 'Decision Gates'



# The DA Process (2)



# Important: consistently and clearly distinguish (terminology)

- **Value drivers or risk factors**
  - Uncertain *model input variables* that may have a material impact on model output KPIs (initially qualitative estimate of sensitivity)
- **Optimization criteria**
  - KPIs ("Key Performance Indicator", i.e. uncertain *model output data*, e.g. NPV, next year's average daily production, etc. They can be computed probabilistically using e.g. Monte Carlo sampling of the model input variables + processing T2B model.
- **Boundary conditions or constraints**
  - Internal/external conditions (e.g. KPIs) that define frame within which to optimize one other KPI (e.g. MAX [NPV | IRR > x; PoT < y] )
- **Decision alternatives** – you control this, these are your optimization controls
- **Scenarios** - you do not control this; scenarios are *uncertain* and can be described as a consistent set of *uncertain model input variables (scalars and/or exogenous time-series)*, underpinned by a "story-line"

## Threat to understanding each other!

- Be explicit and precise
- Agree on and use a clear **terminology** for risk, scenario, decision, driver, risk factor, hurdle rate, constraint, assumption, etc.

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