How can DNV GL contribute in Project Preparation?

Regional Meeting of Asia-Pacific Least Developed Countries on Sustainable Energy
Kathmandu, Nepal
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Agenda

1. Introduction to DNV GL and DNV GL Energy
2. Due diligence
3. Climate adaptation & resilience
4. Rural sustainable power generation
1. Introduction to DNV GL and DNV GL Energy
We are a global classification, certification, technical assurance and advisory company
An energy powerhouse, supporting the energy industry across the value chain, from policy to use, with strategic advise, planning, implementation and energy delivery optimization.

**Service Lines:**
- Markets and Policy Development
- Power System Planning
- Renewable Energy Integration
- Asset Management, Operational Excellence
- New Energy Technologies

**Key Deliverables:**
- Business strategy across all markets
- Power system design and modelling
- Technology implementation services
- Operations and systems optimization

**Innovation accelerators:**
- Smart Grids and Smart Energy Cities
- Super grids and Micro grids
- Energy storage and renewables
- Data analytics and Cyber security
We provide independent assurance

Governments:
• Set up regulatory framework
• Technical master planning / road mapping

Project developers / Investors (vendors, buyers):
• Technical and Environmental Due Diligence
• Power price curve forecasting
• Business plans (development, review)
• Certification of assets, e.g. wind turbines, solar plants, hydro plant

Asset owners / operators:
• Asset management planning
• Operations & Maintenance strategy (development, verification)

Manufacturers of power equipment:
• Testing and certification of equipment

Community:
• Capacity building, training
2. Due diligence
Where do DNV GL and Financial Institutions, Investors, and Developers meet?

- New technology assessment
  - Bankability
  - Technology readiness
  - Start-ups
  - Strategy development
  - Road mapping

- Due diligence – energy assets
  - Technical
  - Environmental
  - Regulatory
  - Cyber security
  - Buyer, vendor

- Risk management
  - Project review
  - Technical, cost and schedule risk assessments
  - Tools and training
  - Quality Assurance

- Knowledge exchange
  - Bridge gap between technical and financial worlds
  - Breakfast sessions
  - Presentations
In recent history we have advised in hundreds of due diligence projects, significantly reducing the investors’ risk position.

OUR DUE DILIGENCE EXPERIENCE IN THE LAST FIVE YEARS

>30 GW
installed capacity in onshore and offshore wind energy

>1,000 projects
concerning solar power installations

>5 GW
installed capacity in thermal power production

>250,000 km
of transmission and distribution cables and overhead lines

>100,000 km
of gas transmission and distribution pipelines

>5,000 km
of heat transmission and distribution pipelines
Theory - Definition Due Diligence (1)

Due diligence takes different forms depending on its purpose:

1. The examination of a potential target for merger, acquisition, privatization, or similar corporate finance transaction normally by a buyer. (This can include self due diligence or “reverse due diligence”, i.e. an assessment of a company, usually by a third party on behalf of the company, prior to taking the company to market)

2. Reasonable investigation focusing on material future matters.

3. An examination being achieved by asking certain key questions, including, how do we buy, how do we structure an acquisition, and how much do we pay?

4. An investigation of current practices of process and policies.

5. An examination aiming to make an acquisition decision via the principles of valuation and shareholder value analysis.

Theory – DD Elements (2)

External Audit: Market and business development, legal, political and socio-economical conditions

Financial audit
- Accountability
- Pension obligations
- Funding tax

Strategic audit
- Strategic goals
- Potential values

Legal audit
- Legal aspects
- Contracts
- Processes
- Regulatory aspects

Environmental audit
- Environmental risks
- Contaminated sites

Organizational audit
- Organizational structure
- Corporate connections

Management audit
- Company culture
- Personnel
- Management structure
- Style

Marketing audit
- Products
- Patents
- Licences

Technical audit
- Site visit
- Technical analysis
- IT
- Risks
- Costs
- Opportunities

Due Diligence Report
DNV GL defines three types of due diligence services within the energy sector

Due diligence

- Feasibility
- Commissioning
- Operations

Product life cycle
DNV GL’s Services in Asset Transactions

**Legal Due Diligence**
- Risk Analysis
- Laws
- Politics
- Country Specific Laws
- Deregulation

**Integral Contractual Arrangement**
- PPA
- Fuel Supply Contract
- O&M Contract
- EPC Contract
- Management Contract
- Concession Agreement
- Shareholder Agreement
- Land Use Agreement
- Credit Contracts

**Public Acceptability**
- Risk Analysis
- Local Support

**Goals**
- Highest Return
- Low Risk

**Risk Analysis, Mitigation**
- Pass Through Insurance

**Market Analysis**
- Demand Side Studies
- Fuel Price Development
- Combined Energy Supply
- Competition Analysis
- Alliances Assessment
- Supply Side Studies
- Country Comparison

**Business Plan Optimization**
- Management
- Operation
- Staffing
- Benchmarking

**Commercial Analysis**
- Sensitivities
- Risk Analysis
- Economical Results

**Technical and Regulatory Due Diligence**
- Dependency on Bankability
- Turnkey Contractor Selection
- Risk Analysis
- Appropriate Sizing
- Technical Alternatives
- Cost Assessment
- Implementation Management

**Project Financing**
- Bankability
- Country Risks
Approach

Kick off Meeting
- Introduction of project teams, finalizing scope and approach, finalizing project procedures

Gather and review contracts and technical DD information
- Review of the Technical Project Concept, contracts, time schedule, systems and component information. Review relevant financial information from contracts and tender documents. Collect and systemise information.

Risk based assessment and analysis
- Based on the review; identify, assess and rank risks within the contractual and technical scope. Establish corrective actions for closing the gaps.

Red flag report
- Based on the risk analysis, identify risks as potential show-stoppers. Update daily

Structure results and write draft report
- Draft report and present to customer. Upon receipt of feedback from customer, provide the final report. The results of the due diligence should serve as direct input to the financial model, reps and warranties

Final report
- Delivery of final report and customer project evaluation
CAPEX Review & Benchmark

DNV GL independently assesses the CAPEX and OPEX of the assets under investigation.

**CAPEX**
We assess all aspects of the CAPEX of the asset.
1. Replacement CAPEX
2. Expansion CAPEX
3. Compliance CAPEX

**Benchmarking**
With our extensive experience we are able to benchmark these costs and make an accurate estimate of the future CAPEX costs related to market, regulation and technical developments.
OPEX Review & Benchmark

- We evaluate the operational expenditures related to the asset.
- We give an independent projection on the development of your OPEX.
- With our 150 years hands on experience we can give an accurate judgement on the costs related to Maintenance and Operation of the asset. Furthermore we can also benchmark these costs against international similar assets.
- For example DNV GL has top class integrity experts in-house to assess the current state and future state of assets at the energy value chain.
Besides an accurate judgment of the costs the expected revenues are thoroughly reviewed.

Future revenues are however highly dependent on future developments of the regulatory framework and the market.

We provide projections of future regulated allowed revenues, resulting tariffs and actual demand developments within the electricity market, and identify and quantify potential risks resulting from future regulatory developments.
Business Case Development

- DNV GL always provides the client with a tailor made solution to assist and support in making a healthy investment decision.
- We review and benchmark your investment decisions
- We give projections on critical contextual developments
  - Tariff development
  - Legal Compliance (new CO₂, environmental or safety standards)
  - Market development (supply and demand projections).
- Based on a diverse set of parameters we independently develop a financial model.
DNV GL Offers Unique Due Diligence Services

- DNV GL has a long history of operational, regulatory and market experience.
- With our multidisciplinary expertise we are able to accurately review, audit and evaluate energy assets.
- We make sure we give an accurate and integrated reflection of the risks, costs (CAPEX and OPEX) and returns accompanying a decision to buy or sell an energy asset.
- We advise, both on the Buyer’s and Vendor's side.
- We cover the entire energy value chain.
- We offer technical, environmental, regulatory and commercial advisory services.
Our Capabilities in Detail

Technical Capabilities
- Assessment of the assets condition / site visits
- Analysis of technical operating data, operating regimes and flexibility of the assets
- Assessment of planning, maintenance and investment (reinforcement and extension) policies
- Forecasting capital and operating expenditures
- Business process analysis
- Application of quantitative methods and techniques
- Environmental assessment / health and safety assessment

Regulatory capabilities
- Establishment of regulatory asset base
- Regulatory treatment of CAPEX and OPEX
- Revenue setting design and modelling
- Assessment of regulatory and political risks
- Risk mitigation strategies
- Institutional analysis
- Economic benchmarking and efficiency analysis
- Financial performance analysis including full-fledged financial modelling

Commercial / Market capabilities
- Analysis of the market design / market arrangements (capacity markets, balancing markets etc)
- Access arrangements
- Quantitative modelling
- Price forecasting
- System expansion planning
- Competition analysis
Our reports identify technical risks, in bankable language, and contain suggestions for mitigation, and impact (CAPEX, OPEX)

<table>
<thead>
<tr>
<th>RISK DESCRIPTION</th>
<th>PROBABILITY</th>
<th>IMPACT</th>
<th>RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased capital and operational costs for overhead lines due to a combination of a high age and a fair or poor condition</td>
<td>High</td>
<td>Medium CAPEX</td>
<td>⬤</td>
</tr>
</tbody>
</table>

**BACKGROUND**

On the overhead lines (110/220 kV), the following information is available in the data room:
- Tower 1 (1946)
- Tower 15 (1954)
- A06 Tower 13 (1975/1976)

According to the supplier, the tower steel quality is appropriate. The total overhead line

**IMPLICATIONS**

Although the overhead lines are inspected according to schedule and the larger part of the assets is refurbished between 2001 and 2006, the major risk is the asset lifetime and condition. The larger part of the overhead lines, about 175 km from the 250.4 km, has an age of more than 50 years. Most critical is the condition of the earth wires and conductors of the overhead lines 1-17, comprehending 95 km, with an age of 60

**MITIGATION ACTIONS**

**CAPEX**

The planned capital investments for 2014 and 2015 comprehend 8 MEUR. For the next 5 to 10 years, another 12 to 18 MEUR of capital costs are anticipated.

**OPEX**

Foundation repair is required on the overhead lines. The foundation repair costs in the most severe repair class are 10 kEUR, the less
DNV GL has advised a wide range of owners of and investors in energy industry assets – a selection of clients is shown below

<table>
<thead>
<tr>
<th>ASSET OWNERS</th>
<th>INVESTMENT BANKS/PRIVATE EQUITY</th>
<th>FUNDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasunie</td>
<td>ABN-AMRO</td>
<td>Goldman Sachs</td>
</tr>
<tr>
<td>Iberdrola</td>
<td>Citigroup</td>
<td>Castle Harlan, Inc.</td>
</tr>
<tr>
<td>Vattenfall</td>
<td>Barclays</td>
<td>First Reserve Corporation</td>
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<tr>
<td>Jabil</td>
<td>Natixis</td>
<td>Pendragon Capital Management</td>
</tr>
<tr>
<td>Fortum</td>
<td>Standard Chartered</td>
<td>Antin Infrastructure Partners</td>
</tr>
<tr>
<td>Eneco</td>
<td>Credit Suisse</td>
<td>Global Infrastructure Partners</td>
</tr>
<tr>
<td>Tennet</td>
<td>Macquarie</td>
<td>Harth</td>
</tr>
<tr>
<td>BBL Company</td>
<td>Investec</td>
<td>Highbridge</td>
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<tr>
<td>Essent</td>
<td>NIBC</td>
<td>Hitecvision</td>
</tr>
<tr>
<td>EnBW</td>
<td>Deutsche Bank</td>
<td>Oaktree</td>
</tr>
<tr>
<td>Google</td>
<td>BBVA</td>
<td>PGGM</td>
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</tbody>
</table>
3. Climate adaptation & resilience
From climate data to adaptation decision making with ADAPT: an application to a Vietnamese coastal city for a regional investor

Adaptation costs

Cost-Benefit Analysis

Climate Projections

Local sea level change
Historic river discharge

Risk Management Measures

ADAPT

Hazards

Storm surge
River flood

Impacts

On planned and existing infrastructure

Recommendations to elevate infrastructure

Risk

Risk-scenario based approach

Private and confidential
Results: coastal flooding maps for various flooding scenarios with inclusion of regional sea level rise

Without Sea level rise

With Sea level rise

An initial screening of different climatic threats, including analysis of regional climate change projections, highlighted the relevance of sea level rise for future exposure of the site against climatic threats. A coastal flooding analysis was carried out incorporating sea level projections.

These results were used to preliminarily evaluate elevation adaptation strategies for the site, for a number of infrastructures.
Raising costs for residential units

- Estimated area of residential building footage: 880000 m\(^2\) (9.5M square feet)
- Adaptive cost of elevation works per squared foot, preliminary range estimate: 32-108 USD

Estimated total cost for residential units [MUSD]  

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25m</td>
<td>290-920</td>
</tr>
<tr>
<td>0.85m</td>
<td>320-950</td>
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</tbody>
</table>
Climate and Weather Databases
Hazard Databases (including LIVEfeeds)
Local hazard – Flooding at East River Electrical Substation (NY)
4. Rural sustainable power generation
Modelling & tooling (economics, dispatch and balancing) – Rural sustainable power generation

Service description
DNV GL has a modelling suit that is capable of a variety of analyses: market models, balancing/ frequency models and load-flow models. The market model optimizes the dispatch of the assets given certain market conditions. The market model assesses the value and the costs of assets in a particular electricity market, such as the European market, but can also be used for island-type systems. The balancing model simulates the balancing frequency and can assess how good an asset can contribute to maintaining the right frequency, or can assess the impact of a certain event on the frequency. Both models can be used for any system/ market and for multiple scenarios of the future. Other tools include operational & investment modelling, used to identify operational value of DER and to incorporate into investment calculations. SOPRA/CSGrip is a modular platform for off-grid (rural) power supply, integrating (optimizing) renewable energy sources, energy storage, and diesel generator (back-up power).

Value for Asia Pacific - Least Developed Countries
• Insight in business cases of microgrids (e.g. optimization of dispatch, microgrid costs vs. selling/buying electricity from the market)
• Independent report on how gen-sets can contribute to the balancing in a system (interconnected and island grids)

Project references
• Medium to long-term price forecasting services for different clients in Europe to (a.o.) assist in investment decisions
• Renewable integration in island grids (e.g. Aruba, CAISO)
• Assessment of the economic impact of alternative balancing product specifications and the benefit of fast gen-sets
• SOPRA/CSGrip: Sustainable Off-grid Powerstation for Rural Applications, optimization tool (optimum configuration of wind, solar, genset, battery)
Analysis – Diesel Generator versus PV usage + Battery usage

- How to compare different scenarios?
- In other words, what should be selection criteria for component dimensioning?
  - Total price / CO2 emission / curtailment / ...
- On which level should system components be? E.g. 60 houses, 5x12 houses, 60x1 house, etc.
Questions?
Thank you

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