Potential regulatory incentives supporting network development

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• Regulatory measures supporting adequate network development
  – Identifying the need for investments
  – Licensing and connection procedures
  – Investment decisions, cost recovery and cost sharing
• Incentives through network tariff determination process
  – New challenges for regulators regarding network tariff regulation
  – General models for determining network tariffs
  – Incentives for cost efficiency and investments
  – The Norwegian model
• Need for special incentives for achieving policy goals?
  – New transmission network development projects
  – Smart Grid development
  – End-user efficiency
Regulatory measures supporting adequate network development

- Planning
  - Identifying the need for investments

- Licensing
  - Getting necessary permits

- Investment decision
  - Economic impact

- Connecting customers

Identifying the need for investments

- Investment drivers
  - Market access
  - Market efficiency
  - Security of supply
  - Quality of service
  - New consumers
  - New generators
  - New policies
Harmonization of network development planning - TYNDP

- Purpose
  - Ensure greater transparency
  - Ensure TSO cooperation
  - Support decisions

- The concept and practice
  - Non-binding plans, updated every 2 years
  - Scenario elaboration and validation
  - Market and network studies
  - Project identification and CBA
  - Report compilation
    - Ten Year Network Development Plan (TYNDP)
    - Scenario Outlook and Adequacy Report
    - 6 Regional Investment Plans

The Norwegian regulations relating to regional power system planning

- 18 planning coordinators, 151 operators
- Responsibilities
  - Long-term power system plan every 2 year
  - Submit comments to license applications
  - Evaluate changes in the power system

- The Power System Plan - Report
  - Describe the power system and challenges
  - Power flow analysis shall be attached
  - Detailed overview of network components
  - Details on energy and power balances
  - Evaluation of the security of supply
  - Available network capacity per municipality
  - Development scenarios for next 20 years
  - Evaluate end-user flexibility and access to other energy sources
Efficient licensing procedures

• Why do network operators need permits?
  – Environmental impacts
  – Economic impact
  – Safety and security issues
  – Ensure that investments are consistent with the power system plans
  – Ensure proper cost-benefit-analysis (CBA)
  – Regulate rights and duties of the licensee

• Should simplify the process of getting necessary permits
  – The “One-stop-shop” approach

Cost Benefit Analysis (CBA)

• Identify any current and future cost and discount to present value
• Identify any current and future benefits and discount to present value
• Discount rate should be consistent with prices
  – Real discount rate if using real prices
  – Nominal discount rate if using nominal prices
• Assess the Net Present Value (NPV Benefits – NPV Costs) against non-quantifiable costs and benefits
Norway’s “One-stop-shop” licensing

- 130 Local Area Licensees
  - Not necessary to apply for licenses for installations 1-22kV (up to 132kV in larger cities)
- Licence per installation > 22kV

Notification → Public consultation → Assessment program

Application & assessments → Public consultation → License

Norway’s “One-stop-shop” licensing

- Description of the project, and it’s costs and benefits
- Justification for the system solution and alternatives
- Security and contingency issues

Environmental impacts
- Land use
- Buildings and living environment
- Outdoor life
- Cultural monuments and landscape conservation
- Plants and animals
- Other natural resources
- Other infrastructure
- Aviation and communication systems

Counter-measures

The whole process is handled by one authority, NVE
Investment decisions

- Adequate economic regulation of networks
  - National responsibilities
  - Transparent methodologies
  - A reasonable return on investments
- Adequate cost sharing mechanisms
  - EU Projects of common interest (PCIs)
  - Costs should be borne by the users
  - Proportionate burden for consumers
  - Transparent cross-border cost allocation based on principles in CBA / TYNDP
- National regulations should support financing of investments in other countries
  - Found OK in the Nordic countries

Efficient connection processes

- Transparent regulation of rights and duties
  - Legal
  - Technical
  - Economic

The Norwegian approach

- Duty to connect all consumers and generators without any undue delays
- Licensee may apply NVE for exemptions if the project is not socio-economic beneficial
- Duty to invest in sufficient capacity, if necessary, without any specific regulatory compensation
- Customers may have to cover the investment costs for assets built only for his/her demand
- Customers may file a complaint to NVE on the process and the technical and economic conditions
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New challenges for regulators

[Images of wind turbines, meters, solar panels, and electric vehicles]
Regulatory models and incentives

- Incentives for efficiency improvements are due to decoupling of revenues from costs
  - Decoupling in time
  - Decoupling by benchmarks
- Incentives for investments are depending on the expected return on investments and risk
  - Higher return → Higher investments
  - Higher risk → Lower investments
- Different models have different incentives
  - Rate-of-return regulation (RoR/Cost+)
  - Price cap regulation
  - Revenue cap regulation

Rate-of-return regulation (RoR/Cost+)

\[ \pi_t = R_t - C_t - d_t \leq \hat{i}_t K_i \]

- Relative simple model, but accounting data required
- No incentives for efficiency due to fixed profits
- Unstable prices if volume risk or cost shocks
- Very low company risk, higher customer risk
- Too strong incentives for investments
- Sustainable if ‘non-economic pressure’ can control the development of cost

\[ \pi = \text{Profit} \]
\[ R = \text{Revenues} \]
\[ C = \text{Operating costs} \]
\[ d = \text{Depreciation} \]
\[ i = \text{Cost of capital (WACC)} \]
\[ K = \text{Regulatory Asset Base (RAB)} \]
Revenue cap regulation

\[ \bar{R}_t = \hat{C}_t + \hat{d}_t + \hat{i}_t \hat{K}_t \]

- More complex model, accounting data and good regulatory skills are required
- Less incentives for efficiency improvements than price cap regulation
- Less stable prices if volume risk
- Low company risk, high customer risk
- Better incentives for investments than price cap regulation, except for those which increase electricity volume
- Sustainable if design properly

Price cap regulation - Simple

\[ \bar{R}_t = P_{t-1} (P_{PI} - \bar{X}) \]

- Simple model, no company specific data needed except for the current tariff level
- Maximum incentives to improve efficiency
- No benefit sharing of efficiency improvements
- Stable prices
- High company risk, low customer risk
- Probably not sustainable in the long run

\[ P = \text{Tariffs} \]
\[ P_{PI} = \text{Price index} \]
\[ X = \text{Efficiency factor} \]
Price cap regulation

\[ \dot{R}_i = \dot{C}_i + \dot{d}_i + i \dot{K}_i; \quad p \leq \bar{p}_i = \frac{\dot{R}_i}{\dot{V}_i}; \quad \bar{P}_i = \frac{R_i}{V_i} \geq \sum_{j=1}^{n} p_j \bar{w}_j \]

- More complex model, accounting data and good regulatory skills are required
- Relatively high incentives for efficiency improvements
- Stable prices within regulatory period, but possible price leaps between periods
- High company risk, low customer risk
- Lower incentives for investments, except for those who increase electricity volume
- Sustainable if designed properly

Efficient, but what about quality?

- The economic regulation can’t take care of everything
  - Efficiency is the main purpose
  - Should be supplemented by direct measures in form of regulations, codes and standards
  - Some quality aspects may be incentivized
    - Quantified in monetary terms
    - Let change in quality impact their allowed revenues
- Quality incentives enhance investments, if proper design

\[ \Delta Q \geq \Delta (C + d + iK) \Rightarrow \Delta \pi \geq 0 \]
\[ \Delta Q \leq \Delta (C + d + iK) \Rightarrow \Delta \pi \leq 0 \]

- \( Q = \) Value of quality
- \( \pi = \) Profit
- \( C = \) Operating costs
- \( d = \) Depreciation
- \( i = \) Cost of capital (WACC)
- \( K = \) RAB
How do investors think?

If I get a return on my investment that is reasonable, taking the risk into consideration, I will invest. Otherwise, I will not!

\[ NPV(i, N) = \sum_{t=0}^{N} \frac{\pi_t}{(1+i)^t} \approx \sum_{t=0}^{N} \frac{(d_t + iK_t)}{(1+i)^t} \geq K_0 \]

- \( i \) has to meet the investor’s expectations and depends on risk
- Rate of return regulation always fulfills the NPV requirement if \( i \) is correct
- If the revenue stream deviates from the one under RoR regulation, you should check the NPV condition

\[ \pi = \text{Profit} \]
\[ d = \text{Depreciation} \]
\[ i = \text{Cost of capital (WACC)} \]
\[ K = \text{RAB} \]
\[ K_o = \text{Investment cost} \]
\[ N = \text{Lifetime of asset} \]

The Network Regulation Model, 2007

\[ RC_i = 40\% \cdot C_i + 60\% \cdot C_i^* \]

- \( RC_i \) = Revenue cap for DSO \( i \), fixed by NVE annually
- \( C_i \) = Cost Base for DSO \( i \) - Own cost, including cost of capital - Approach: Rate of Return regulation (RoR)
- \( C_i^* \) = Cost Norm for DSO \( i \) – Estimated by NVE
  - Approach: Yardstick competition → Incentives
    - Decided by average efficient, comparable DSOs
      - Similar network structure and environmental factors (Z-factors)
The Network Regulation Model, 2007

\[ AR_i = RC_i + PT_i + TC_i + TL_i - VOLL_i \]

- \( AR_i \) = Allowed revenue for DSO \( i \), calculated by NVE
- \( RC_i \) = Revenue cap for DSO \( i \), fixed by NVE annually
- \( PT_i \) = Property taxes
- \( TC_i \) = Tariffs paid to other networks
- \( TL_i \) = Mechanism for removing time lag for investments
- \( VOLL_i \) = Value of Lost Load (interruption costs for customers)

NVE checks annually each company’s collected revenues against the allowed revenue and update the excess/deficit revenue balance. NVE follows up that the companies set the tariffs to reduce the balance over time.

Cost Base

\[ C_t = (OM_{t-2} + VOLL_{t-2}) \times \frac{CPI_t}{CPI_{t-2}} + (L_{t-2} \times P_t) + DEP_{t-2} + RAB_{t-2} \times i \]

- \( OM \) = Operating and Maintenance costs
- \( VOLL \) = Value of Lost Load (customers interruption costs)
- \( CPI \) = Consumer Price Index (inflation)
- \( L_{t-2} \times P_t \) = value of network losses. Losses in MWh, year \( t-2 \). Priced at local area prices at Nord Pool Spot in year \( t \)
- \( DEP \) = Depreciation
- \( RAB \) = Regulatory Asset Base (book value)
- \( i = WACC \) = Weighted Average Cost of Capital

The WACC is essential for the companies willingness to invest and ability to handle debt.
Weighted Average Cost of Capital (WACC)

\[
WACC = (1 - G) \times \left( \frac{R_f + \beta_e \times MP}{1 - t} \right) + G \times \left( R_f + P_d \right)
\]

- \( G \): Gearing (debt ratio)
- \( R_f \): Risk free rate of return, usually a Government bond 5Y or 10Y
- \( \beta_e \): Equity beta, measuring the risk compared to stocks
- \( MP \): Market Premium in stock market compared to the risk free alternative
- \( P_d \): Credit Premium, the premiums banks requires on debt compared to the risk free alternative
- \( t \): Company tax

- If CoE is too low, investors will not be willing to invest
- If CoD is too low, companies will not be able to pay off debt

The 2012 WACC assessment

Credit risk
Risk free rate
Market premium
Beta
Gearing

ERRA Video Presentations 2013 / Tore Langset
New WACC-model for 2013

\[
WACC_{pre-tax} = (1 - G) \times \left[ \frac{R_f + \text{Inf} + \beta_e \times MP}{1 - t} \right] + G \times (\text{Swap} + P_d)
\]

- Gearing (G): 0.6 - Debt/equity share: 60/40
- Asset beta: 0.35 (equity beta \( \beta_e \): 0.875)
- Tax rate (t): 28%
- Real risk free rate for equity (\( R_f \)): 2.5%
- Inflation (\( \text{Inf} \)): Average of 4 years inflation (t-1, t, t+1, t+2), updated each year.
- Market premium (\( MP \)): 5% (increased from 4%)
- Nominal debt rate (\( \text{Swap} \)): Annual average of 5-years swap rate
- Debt premium (\( P_d \)): Annual average of credit spread for 5-years bonds for the power sector, min rating BBB+

The impact of the amendments

- Short term effect: Tariff increase of 7-9%
- Long term effect: Tariff increase of approx. 1.5%
Why is the regulation better now?

• Annual revenue caps (2007) using yardsticks because:
  – Gives strong incentives for cost efficiency
  – Takes care of cost shifts at industry level automatically
  – Removes time lag for investments ensuring a reasonable return on investments for average efficient companies
  – Incentives investments due to the VOLL arrangement and a reasonable level of the WACC

• The new WACC model from 2013 because:
  – Is more robust against disturbances in the financial markets
  – Is more robust against fluctuations in the Government bonds
  – The return on equity will be closer to the investors expectations

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Incentives for cross-border investments?

- Depends on the regulation of the TSO
  - Higher risk for TSO, higher return required
- Cost allocation methods for TSOs are important
  - A challenge to determine the sharing of benefits
- National regulators should ensure that shared costs for projects of common interests can be recovered through the TSO’s tariffs
- Transparent and efficient licensing procedures

Incentivising smart grid development?

- Depends on
  - how smart it is with smart grids
  - how urgent smart grids are
  - how the general regulation works
  - the risk of the smart grid project
- Should be careful with general incentives
  - Is not very targeted
  - Can be very costly
- Should support R&D and pilots to learn more
  - The risk is mainly that we have to little knowledge about the costs and benefits of smart grids
Incentivising end-user energy efficiency?

• Should be careful using network tariffs to affect end-users consumption
  – Creates economic inefficiencies
  – Unless tariffs reflects true network costs
• Increased end-user flexibility may contribute to a more efficient power market
  – Most likely to shift consumption, rather than reduce it significantly
• Should support R&D and pilots to gain more information about consumers response to prices

Thank you for your attention!

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