SUMICSID

Dynamic Regulation

AG2:V1 – FINAL REPORT

Per Agrell
Peter Bogetoft

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Disclaimer

This is the final report on a subproject on ex-post regulation, commissioned by the Norwegian Water Resources and Energy Directorate (*NVE*) under the premises of the AG2 working group, delivered 2003-09-01 by the authors, professors Per AGRELL and Peter BOGETOFT for SUMICSID AB.

The contents has only partially been subject to review from the Commissionee during a seminar 2003-06-12 and expresses only the viewpoint of the authors, who exclusively bear the responsibility for any possible errors.

Table of Contents

Summary

Somewhat simplified, the principal choice between ex-ante and ex-post instruments is derived from the role the regulator assigns himself in the market, and from the roles of the institutions and actors in the regulation approach.

Theoretical and empirical evidence show that all intervention in the market comes at a cost in terms of social welfare. Cost-plus regimes create growing and inefficient giants, rate-of-return distorts the investment profiles and supports 'tariff-investments', revenue-caps are in reality implemented as lagged rate-of-return regulations with a higher capital cost. In the meantime, the administration of these heavy-handed instruments requirse an ever-increasing mending and fixing of detailed regulation to block loopholes. When a less informed party plays customer, firm and market in the same person, the result is not sustainable.

When regulation is more than the passive monitoring of production, care should be taken to take into account not only the "optimal" mechanism that may be conceived for the market, but also the institutional design to foresee reaction of the incumbent and entering agents during the transition from the existing regime. Regulation in this sense is more than a surveillance of a self-regulating market; it is the creation of a new market with a more or less pronounced role for itself as contracting part.

In this progress report on a dynamic and evolving regulation approach, we summarize the main motivations for a comprehensive view on regulatory consistency. The resulting concept, the regulatory path, is defined and illustrated using a three-stage scenario that takes market contestability as an ultimate goal.

1. Introduction

Background

1.01   Prior to the regulatory revision 2007, NVE has appointed three working groups by representatives from the industry, consumers and NVE to prepare a regulatory proposal. The first stage of this process, spring and Summer 2003, the working groups are supported by consultants and researchers. The full project plan is available at the NVE website.

1.02   Workgroup 2 (AG2) wishes to clarify a series of regulatory issues related to the following sub-projects

> V1: Ex ante versus ex post regulation
>
> V2: Norm values
>
> V3: Use of menu of incentive contracts

1.03   NVE commissioned 2003-04-11 sub-projects V1, V2 and V3 to SUMICSID, subject to some revised directives that will be iterated below.

1.04   A fourth subproject on cost accounting in regulation, was subsequently commissioned to SNF.

Time frame

1.05   The overall project plan is described in Project Plan 2003-04 and proceedings of the NVE first workshop 2003-04-28/29.

1.06   The approach and supporting evidence from subprojects V2 and V3 were subject discussed at the second NVE workshop 2003-06-11.

1.07   This report is the final report of AG2/V1, presented at an open seminar 2003-09-01. The report has been subject to internal discussion with the AG2 working group at a meeting 2003-08-21.

Objectives

1.08   At this project stage, we suggest that it is important to start thinking of the dynamics of the possible regulatory reforms and to start integrating the different elements in more specific, workable schemes. Our proposal is therefore guided by three general principles, viz *concretization, synthesis* and *dynamics*. We expand on these in this report.

1.09   The *aim* of this sub-project is to evaluate if light-handed ex post regulation is a desirable alternative to the regulation of today. An aim is also to suggest a limited number of desirable and workable ex post elements as a supplement to today's regulation.

1.10   The sub-project definition by NVE involves four *elements*
  1)   Criteria to be used for choosing the timing of regulatory elements
  2)   Evaluate the relevance of light-handed ex post regulation and the needed transformation from today's regimes
  3)   Evaluate which elements to settle ex ante and ex post in a heavy handed regime
  4)   Evaluate and describe actual ex ante and ex post models.

Take-aways

1.11   At the completion of the AG2 work package, NVE will have the following products from the three subproject in this:
  1)   A pragmatic and comprehensive proposal for a regulatory reform plan, including criteria, time windows and requirements to sequentially introduce new ex post instruments to improve upon the current regime.
  2)   Theoretical and operational analysis of different approaches to norm values in regulation, including evidence from implemented approaches, along with recommendations of potential usage in the Norwegian regulation.
  3)   An exploratory study on menus of contracts in regulation, including an evaluation of the strengths and weaknesses with the use of such instruments in the Norwegian regulation and a proposal for potential further studies to develop such instruments.

Scope and limitations

1.12   The current project on dynamics in regulation, including recommendations for the approach, mechanisms and implementation timing, is primarily oriented towards the regulation of electricity distributors in unbundled energy markets. Their activities

stand for the lion's part of the overall transport work in the market and also the highest total costs. The particularities in scope and size of transmission networks require substantially different regulatory approaches, developed in more details in Agrell and Bogetoft (2002b). No position is taken in this report on the issue of optimal regulation of regional transmissions networks, which merits focused attention.

Outline

1.13   In Chapter 2, we give an overview of the virtues of dynamics and temporal consistency in regulation. Chapter 3 provides some arguments for revising the current regime and suggests some principles for goal setting. The logic is carried forward in Chapter 4, where a dynamic framework is presented based on these values. Further concretization of the concept is offered in Chapter 5, where a proposal for three stages with varying level of detail is given. The progress report is closed by some further work in Chapter 6.

2.   Dynamic Regulation

2.01   Below, we will set the stage for later developments by defining regulation from a dynamic perspective and quickly analyzing the challenges to the current regime.

Regulation is a long-term game

2.02   Electricity distribution is a classical example of an infrastructure industry with strong dependency on capital investments, low marginal cost and strong network externalities in grid expansion and operation. The technical and economic life of the average network asset largely surpasses any regulatory period, if not the tenure of the owners and regulation itself. Yet, investments have to be undertaken sequentially and costs allocated into an uncertain future, which naturally puts the attention of the managers and owners to the regulation.

2.03   On the other hand, optimal regulation depends on the information that can be assessed or produced in the industry, which leads to an interest in the market and industry structure. Regulation of a few very large firms is likely to focus at different challenges (collusion, market power) than in the case of a large number of very small firms (coordination, economies of scale).

2.04   Part of the difficulty for the regulator and the firms to anticipate future costs and revenues is linked to the endogeneity of the process and market development. The allocation and total amount of rents that the regulator leaves to the industry determine the potential for internal process development and innovation, as well as structural changes in the type, size and scope of firms in the market. As shown in Agrell and Bogetoft (2003a) on ex-post regulation, "successful" rent extraction (low short-term consumer tariffs) by regulators has in practice been associated with risks of halting process innovation, improvement and management recruitment. On the other hand, empirical results from excessive and lax regimes show the implicit promotion of anti-competitive arrangements by incumbents with the aim to block entry.

2.05   The endogenous character of regulation, industry response and market/process development is illustrated in Figure 2.1 below, where

the exogenous influences from technology/market innovation and market entry are indicated.
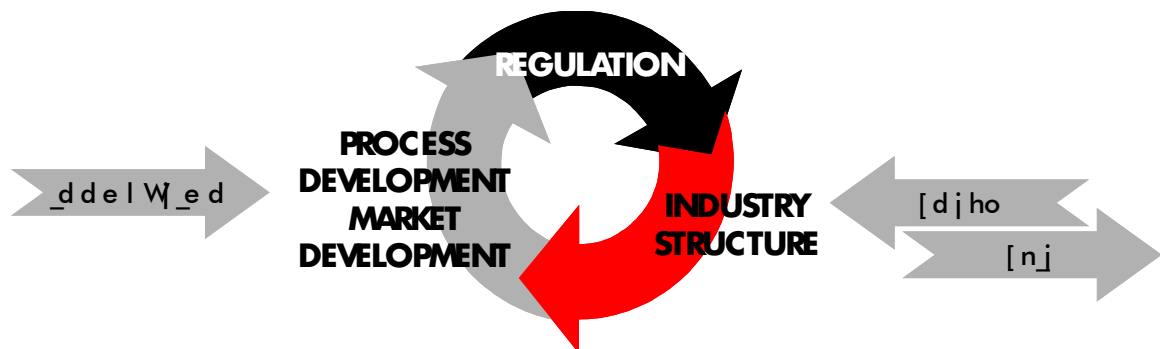

Figure 2.1 Regulation, industry structure and market development in interaction.

2.06   If we now add a time dimension to the regulatory game in Figure 2.1, it becomes apparent that the decision makers involved need to take into account not only current conditions (regulation, market structure), but also the past as indications of the future situation. Of particular importance is of course the credibility the regulator signals when changing or updating regulation [regimes/parameters]. As pointed out in the FP2 report Agrell and Bogetoft (2003a), any positive results from a fixed-price regime, such as CPI-X, depends on a credible commitment from the regulator not to penalize revealed efficiency (ratchet effects). Some signals are irreversible, or at least long remembered by industry and market, which makes it difficult to revert to an earlier state once they have been emitted. E.g., administrative requirements that implicitly penalize small networks can in the long run incite horizontal integration (mergers). However, even if the original administrative costs are reduced later on, the merged firms are not likely to split up for this reason only.

2.07   The anticipation of future regulation is inevitable, as the investments carry so far in time. Thus, in the absence of information on possible regulatory changes, historical and imperfect information on political and economic tendencies become influential in the investment decisions of firms. This uncertainty is counterproductive, as less informed decision-makers are forced to anticipate reactions of regulators, who in their turn are eagerly awaiting the decisions of firms to monitor the regulation. The wheel of information in Figure 2.1 can in this way be both a positive cycle of improvements and adaptation, or a negative cycle of uncertainty and underperformance.

The idea of dynamics

2.08   Regulatory reform is a positive sign of economic dynamics. However, as sketched in the previous section, the characteristics of the electricity sector necessitate more than temporally optimal solutions. First, the discussed interdependency means that a regulation regime is optimal only with respect to a certain industry and market situation. Change is inevitable in the long run, as the technology and process may mature. Second, the time and resources spent in transition between regimes may finally be as important as the "steady state" or equilibrium state, since the operations are characterized by high capital intensity. As will be discussed below, there may not even exist any terminal state, but just an ongoing transition process. Third, to be effective, the gradual development of the market needs to be guided by unambiguous signals about the *direction* of development, rather than the exact *mode* of future regulation. These signals should be credible with respect to prior regulatory history and institutional independence.

2.09   In this project, we will develop a dynamic framework for the regulation that clarifies the objectives, means and modes of current and future regulation. To adhere to allocated resources, the dynamic plan, or *trajectory*, will be defined in detail only for the first stage, subsequent stages are only sketched and will certainly be subject to further studies and discussions.

Consistency improves social welfare

2.10   By acknowledging the dynamic nature of regulation, the trajectory allows NVE and firms to focus on relevant short-term and long-term actions, which directly reduces the amount of double or irrelevant investments. Also, administrative costs can be reduced as costly improvements of imperfect, transitory regimes can be avoided. The consistency, reducing regulatory uncertainty, can furthermore help supporting progressive and useful organizational learning and adaptation in all segments of the market.

Consistency improves network design

2.11   Long-range goals in combination with a coherent plan of implementation can provide clear and unambiguous investment signals for firms. Investments in technology and innovation,

potentially across sectors, can also be triggered, or definitively discouraged, by open cards on the regulatory trajectory.

Consistency is to best use local resources

2.12 A consistent plan pays explicit attention to local current conditions, without sacrificing advantages due to poor transition planning. Indirect impacts of regulation on firm scope, size, governance and information structure will be addressed. Gradual and smooth changes allow for learning and adaptation by the current firms, rather than the pre-emptive entry of potentially more opportunistic firms.

Outline

2.13 In the next chapter, the current regulation is briefly revisited to highlight some potentially weak areas. A regulatory long-term vision is then deduced from public NVE policy and an analysis of regulatory viability. These are the building blocks for the regulatory trajectory that follows later on.

3.   Challenges

3.01   The current regime will initially be classified in terms of the concepts developed in FP2 Agrell and Bogetoft (2003a, 3.09).

3.02   The core of the current NVE regulation regime is an ex-ante revenue cap for periods t=1,..., 5 years, calculated as

$$R_t = PI_{t,t-1} \bullet QI_{t,t-1} \bullet (1-\pi-\varphi \bullet G_t) \bullet R_{t-1}$$

where $PI_{t,t-1}$ is an inflation adjustment factor, $QI_{t,t-1}$ is a quantitative adjustment factor (equal to $y_{pow}^{t} - y_{pow}^{t-1})/2\ y_{pow}^{t-1}$ where y_{pow}^{t} is the gross output of power at time t), π is an imposed cost efficiency requirement (1.5% in NVE (1997)) (a proportional revenue reduction), G_t is a measure of individual inefficiency (equal to $\min\{(1-E_0)/(1-E_{min}),1\}$, where E_0 is the historical cost efficiency at time 0 in the CCR DEA model, E_{min} is the lower limit for efficiency scores (0.70 during 1999) and φ is the annual efficiency catch-up factor (3% in NVE (1997)).

3.03   The maximum revenue is given as

$$R_t \leq c_t + \gamma^{max} \bullet X^{cap}_t$$

where γ^{max} denotes the maximum allowed rate-of-return (15% in NVE (1997)), X^{cap}_t denotes the capital base of the agent at time t and c_t is the actual cost at time t. The revenue floor is analogously given as

$$c_t + \gamma^{min} \bullet X^{cap}_t \leq R_t$$

where γ^{min} denotes the minimum prescribed rate-of-return (2% in NVE (1997)).

3.04   Some observations can already be made regarding the regulatory mechanism. First, it implies a mixture of ex-post and ex-ante elements. Ex-post updating is made of delivered volume ($QI_{t,t-1}$) and inflation ($PI_{t,t-1}$). In practice, a lagged updating is used of the efficiency term (G_t). Second, it draws on two techno-economical assumptions regarding the economies of scale ($QI_{t,t-1}$) and the factor price development ($PI_{t,t-1}$). Third, the impact of the efficiency term is cushioned directly by truncation and weighting and indirectly by the revenue ceiling and floor. Fourth, the mechanism contains no less

than five regulatory policy parameters (γ^{max}, γ^{min}, φ, E_{min}, π) that partially interact and offset each other. Sixth, the efficiency model behind G_t and the revenue window are input-oriented, whereas the revenue cap structure suggests an output-orientation. Seventh, the quality regulation KILE intervenes twice in the revenue determination, directly and indirectly through the efficiency term. A similar observation can be made for the volume of distributed energy that leverages the formula.

3.05   The efficiency model G_t, analyzed in FP4 Agrell and Bogetoft (2003b), is a highly aggregated model with rapidly lowered discretionary and informational value. Already, a high number of firms show full efficiency and it is not clearly documented why the remaining firms have not caught up with the frontier.

3.06   Without preempting the results from AG1, nor referring to the numerous prior evaluations that have been undertaken, we conclude tentatively that the current regime is one of the most advanced in regulatory use (cf. Agrell, Bogetoft and Tind, 2002). The mechanism is clearly the result of compromises between different orientations, competitiveness and cost-recovery, efficiency incentives and limits on monopoly and information rents. Mathematically and theoretically, the model can be shown to be optimal with even fewer parameters, under some conditions (idem.) However, from a dynamic perspective, the current formula has primarily two weaknesses: First, the mixture of elements is complex and lacks transparency for decision-making. Second, which is directly linked to the first point, the parameters in the model are powerful and potentially useful, but their application lacks any systematic plan or principle. By keeping many possibilities open, the resulting regulatory uncertainty is neither promoting competition through entry or restructuring, nor long-term cost-recovery for incumbents.

3.07   Behind the model, the assumption that all firms maximize net period profit is crucial, yet not verified. Hypothetically, if some firms would pursue other goals (which indeed is the case in Agrell and Bogetoft, 2002, and Kittelsen, 199X), the entire approach is implicitly biased towards a transfer from these firms to profit-maximizing firms. The crucial issue is then whether the firms with diverging objectives still maximize long-run social welfare, in which case the regulation is suboptimal. The question could be studied from an ex-ante empirical viewpoint, by questionnaires etc. Another approach would be to explicitly assess the responsiveness of firms to incentives by offering some simple and clear alternatives. As will be shown in project

AG/V3, the use of such menus can be advantageous from both a practical and theoretical perspective.

Challenges

3.08   Whatever regulation is designed in the ongoing reform, it will face a number of potentially complicating future issues.

3.09   *Bundled services*. The growing international tendency to provide network services by joint investments and coordination across sectors (telecommunication, railway signals, cable-TV, ADSL, etc.) will naturally provide the possibility for distributors to offer bundled services. Clients could e.g. get maintenance of their signal network coordinated with preventive maintenance of electric networks, or final customers could cut costs on ICT costs by utilizing existing grids. Per se, these initiatives are positive and welfare enhancing. The challenge is then to assure that these services do not distort competition between firms, or within the concession. As the information asymmetry in this area can be considerable, doubts can be raised to the long-term viability of input (cost)-based regulation.

3.10   *New organizational forms/Multi-utilities*. As discussed at length in FP5, Agrell and Bogetoft (2003c), utilities that offer more than one concessioned network service may realize some economies and customer advantages. Apart from obvious coordination gains in maintenance, there are also investment opportunities and improved planning information to be gained. The future regulation will need to take a stance on vertical re-integration; accounting rules cannot replace the factual operations and the cost allocation issue. Once again, this potential threat is primarily focused at input-oriented regulation.

3.11   *Non-grid investments/distributed generation*. In remote areas or for load with non-standard profiles, innovative utilities have proposed alternative solutions to grid expansion, such as DSM or distributed generation. The Norwegian market development in this stream is still too modest to fully anticipate its consequences, but some implications for the concession concept and the universal service obligation can be postulated. Albeit further in the future, such development may limit the possibility to generalize the use of industry-wide efficiency measures in regulation.

3.12   *New financial/accounting solutions*. One of the least costly adjustments to regulation involves reporting, allocating and financing given activities such that the firm maximizes revenue and retains operational flexibility. More or less transparent solutions of leased grids, outsourced staffing, coordinated tender of power for lost load etc. are already in effect in all four Nordic countries. Here the regulator faces either an ever-more complicated and detailed (heavy-handed) information gathering, or a gradual emphasis on verifiable output measures. We will argue that this "accounting efficiency" is perhaps the most unproductive use of societal resources (cf. tax rules) and that it should be avoided whenever possible.

3.13   *International dimensions*. The increasing foreign ownership of Nordic energy generators, distributors and retailers opens an all-new range of information and coordination gains. Unfortunately, it also prompts for a careful analysis of regulatory consolidation and coordination (cf. FP5 Agrell and Bogetoft, 2003c) to assure that competition is not distorted and that clients are not disfavored. In our context, a clear and transparent short- and long-term regulation is probably the best way to promote sound initiatives and to balk opportunistic entrants.

Two extreme orientations

3.14   Before proceeding to a proposed operational short- and long-term objective, a brief review of two principal data approaches: the input- vs. output-orientation. The discussion below draws mainly on Agrell and Bogetoft (2003a, Ch 7).

3.15   An *input-oriented* regulation approach relates primarily to cost-data when designing the mechanisms. The motivations are usually related to observability (easier to audit costs than network "utility") and better information on the *process* than the *service*. The orientation has roots in a long tradition of low-powered regimes, where public or semi-public enterprises have slid from budget control to a similar light-handed input regulation. Many firms may not be entirely opposed to such orientation that mimics their internal cost allocation processes and usually guarantees cost recovery. However, the orientation is easily subject to ratchet effects (where decreased cost implies decreased budget, i.e. decreased profit) and, moreover, a deep monopoly structure of the market. Rather than working with the fuzzy service definition towards the customers, firms and regulators engage in all more counter-productive arguments about the costs of the process.

3.16   An *output-oriented* regulation approach primarily uses data from final consumers, such as services offered and their final prices, in the mechanism. A prerequisite for this orientation to work is a clear service definition, usually in close collaboration with clients. On the other hand, cost data and process involvement become irrelevant or less important, delegating the tradeoffs and development to the firms. The regulator here takes a different role and concentrates gradually more on prevention of quality skimping and market conditions. Although the orientation is usually combined with high incentives, firms from protected markets may consider the output-focus as risky, potentially removing bankruptcy protection. The output-orientation is the closest to contestable markets, and the regulator can moderate its involvement as alternative processes or client bargaining are strengthened. Insofar as the firms embrace the orientation, they will be well prepared to act in deregulated or semi-competitive regimes, even internationally.

Regulatory objectives and orientation

3.17   The current NVE regime is a hybrid between the two orientations, as are most implemented electricity distribution regulations. However, in constructing a clear and concrete vision statement for the regulatory development, given the behavioral effects, the beneficial change of regulatory role and the increased stress on future cost-data, we strongly argue for an output-focus as an ultimate orientation.

3.18   The idea behind the dynamic regulation now becomes clear and concrete – it is to gradually prepare the industry (and NVE) for a future more competitive and contestable market. Each step stone on the road towards this stage is then to support a particular dimension that needs to be assured before the next step can be taken. Uncertainty is reduced, but social welfare is increased, as the road is clear. Common and separate efforts can now be aligned to prepare the steps in due time and without haste.

3.19   The next chapter illustrates the concept with a concrete example.

4.   Dynamic Regulatory Path

4.01   Given that we foresee economic, operational, behavioural and informational difficulties to maintain an input-oriented regulation regime in the long run, we assert that a competitive and contestable output-oriented regime is a viable regulatory vision. However, it is neither realistic, nor socially optimal, to destroy the current industry and market structure in a drastic change. The lowest (social) cost transition from the current situation to the desired situation is what we call a *regulatory path* or *trajectory*.

4.02   The major indicator of progression in Figure 4.1 during the transition is the level of granted and accepted *delegation* that the industry enjoys. The final stage can only by achieved if the service coordination mainly rests at the firms, yet to provide social welfare, delegation can only be awarded as firms accept the commercial and technical conditions that are intimately attached to it.

4.03   The horizontal axis in Figure 4.1 can be labelled "time" or "market development" or as the need of adjustment time is explicitly acknowledged in the approach. Indeed, there is reason to believe that organizational learning and adjustment, as well as client maturity, will be an important and interesting dimension in the regulatory reform. It can also be called "market orientation", as a movement to the right signifies an increased attention to service/output, rather than cost/input, attributes.
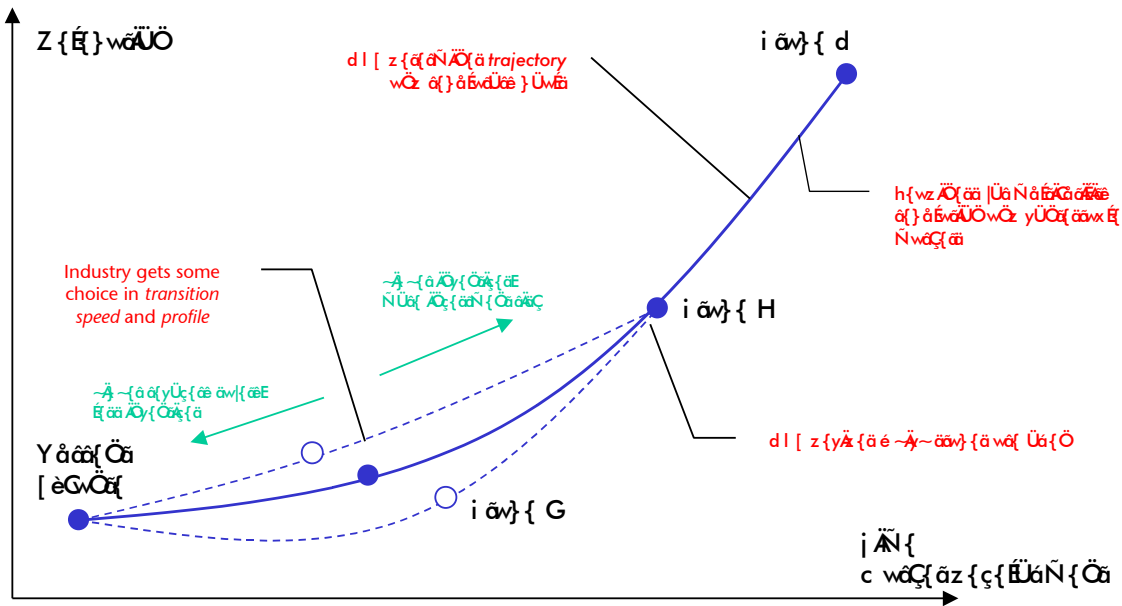
Figure 4.1 Regulatory trajectory.

Stages

4.04   A *stage* is a regulatory approach (mechanism, institutions and market) that is in effect at a given time along the path. Given the sequential character of the regulatory path, the closer stages are more detailed than the farther intermediate stages. In this manner, new information and knowledge can affect the design of each subsequent stage, without jeopardizing the direction.

4.05   The *path* is dynamic as it evolves over time. Although illustrated as continuous below, it is uniquely defined by the (discrete) stages and could thus be depicted alternatively.

4.06   The design of stages is a double challenge, in that their number, duration and characteristics will affect effectiveness of the regulation. In Table 4.1 below, a quick evaluation with regard to the number of stages is offered. A pragmatic approach to this challenge may be to distinguish a limited series to economic and technical criteria that indicate the progress towards the goal. Below, we sketch such scenario, where the two main concepts contained in the final goal are *competitiveness* and *output-orientation*. A minimum number of stages should at least allow firms to adjust to these concepts separately. The final integrative stage can then be defined as the combination of the two, whenever this is realized.

Table 4.1 Choice of stages.

Evaluation (positive +, negative -)	Few stages	Many stages
Adaptation possibility	-	+
Administrative costs	+	-
Transparency	+	-
Investment incentives	+	-
Adjustment complexity	-	+

Discover, Learning and Information Asymmetry

4.07   Part of the motivation behind the dynamic stages is a modern view of regulation and operation under regulation as a learning and discovery process (cf. Wiesman and Pfeifenberger, 2003). According to this theory, the asymmetry of information is double, in the sense developed in Agrell and Bogetoft (2003a). The optimal cost and service is a moving target that at any given time is unknown to the regulator as well as the firms. By investing time and resources, the regulator or the firms may discover part or all of the technology. The investment for an external party, as the regulator, will be higher than for a firm, which motivates the idea of delegation. On the other hand, the capacity of a firm to discover and digest the new information is limited by its technological, organizational and management resources. Simple high-powered regimes that that in theory would reveal private information by firms would in this view not necessarily give more than short-term cost reductions by a subset of the operators. The proposed regulation exposes the sector to new incentives and new horizons, but gradually as to permit to all firms to join the learning process.

First Stage: Competition

4.08   The first stage will introduce an industry-competitive element to focus at inter-firm relations rather than regulator-firm interaction. By assigning high incentives only to competitive actions, excellence and catch-up are promoted. The regime also sends a credible signal to entrants and incumbents that the counter-productive efforts such as accounting distortion, lobbying and attempts to capture regulator or politicians will not guarantee high rents.

Second Stage: Output-orientation

4.09   Once the competitive element has been firmly established, the focus is ready to evolve from internal process competition to external values for final customers. For the final client, what matters is not whether the service provider has an cost-efficient level of costs, but what he/she pays in total for the service. In this stage, the regulator delegates the responsibility for costs, operating expenses as well as capital costs, to firms in return for instruments that are based on observed services and their final chain costs. Consistent with the competitive focus of the preceding stage, the regulator has now gained informational advantages in the service definition, but leaves the price development to the market. The incentives for efficient firms are high, as in any (pseudo-) competitive market

Third Stage: Contestability

4.10   The second stage is not a viable long-run phase, as it still draws on the regulator as the "market clearer" using national observations. Market restructuring in the vertical or horizontal sense may signal that the industry is mature to proceed to the final stage, where competition and output-orientation is combined into a more contestable market. In other deregulated industries, solutions of this kind have been found in either franchise auctioning instruments, if there are a significant number of qualified actors, or a "Charter-like" light-handed approach if considerable economies of scale have created a few operators. In this final stage, a number of powerful instruments still rest at the regulator's disposal, such as the concessions and the service obligation contracts.

Characterization of the Stages

4.11   Below, we give a short characterization of the stages in Table 4.2, where stage 0 is defined as the incumbent regime. Concerning the optimal time and duration of the stages, our assessment for the first stage is only a rough estimate of the adaptation speed demonstrated after the 1997 regulatory reform. Two regulatory periods may be the minimum time, given that conservative, yet efficient, firms may want to study the impact of competition "from the side" one period before revealing their potential. Thus, the reliable sector response does not likely occur until the end of the second period, when enough comparative material exist. However, as pointed out above, one could also let the menu choices guide the transition speed to some extent, perhaps by judging the number of firms on yardstick in the

preceding period. A similar point holds for the somewhat illusory final point for the second output-yardstick regime. As the transition is triggered primarily by the industrial structural changes of scope and scale, we are in no position to provide any reliable estimate. However, by assigning a high number (at least 30 years), we signal that such development is clearly not the first priority in this reform, and that there is plenty of time to tailor the third stage to the potential market structure of the future.

Table 4.2 Characterization of stages. (Cf. FP2, Agrell and Bogetoft, 2003a)

	Stage 0	Stage 1	Stage 2	Stage 3
Orientation	Input (Cost)	Input (Cost)	Output (Service)	Output (Service)
Approach	Revenue cap with ind. efficiency targets	Cost yardstick Revenue cap	Output yardstick	Light-handed regulation
Instruments	CPI-DEA,X	Menues DEA-Yardstick	DEA-yardstick	Concessions Service reviews
Information	High collection	High collection	Limited collection	Selective collection
Risk sharing	Firms/clients	Firms, depending on menu choice	Firms, lower idiosyncratic risk	Firms
Delegation	Mixed	Firms	Firms	Firms
Commitment	Ex ante (ex post for inflation)	Ex post / ex ante	Ex post	Ex post
Discretion	Medium	Low	Low	High
Role of regulator	Contractor	Market maker	Market clearer	Market monitor
Focus of regulator	Rents, quality and efficiency	Quality and rents	Anti-collusion	Contestability Entry
Length of stage	10 yrs	10 yrs	> 30 yrs	Indefinite
Investment review	Regulator	Firms	Firms	Firms

Evaluation of the Stages

4.12   First, we dare a brief evaluation along the regulatory structural criteria proposed in Agrell and Bogetoft (2003a), Fp2 Ch. 4, listed in Table 4.4. The main difference in this respect between the current regime and the first and second stages is the pseudo-competitive principle, that radically changes the roles in the market. As the

performance targets are set by the sector rather than by external forecasting, considerable coordination gains are possible. Further, this yardstick mechanism is the strongest yet least risk-introducing incentive available. The ex post settlement provides additional risk adjustment for idiosyncratic shocks (technological changes, inflation, natural catastrophes), which lowers the cost of risk.

4.13   The final stage of contestable markets is characterized by a high level of delegation where the role of the regulator will depend on the exact structure of the market.

Table 4.3 Contractual analysis of stages. (Cf. FP2, Ch. 4)

Focus	Concern	Stage 1	Stage 2	Stage 3
COORDINATION	1. Coordinate production	+	+	+ +
	2. Balance the pros and cons of decentralization	+	+	0
	3. Minimize the costs of risk and uncertainty	0	+	+
MOTIVATION	4. Reduce the costs of post-contractual opportunism	+	+	+
	5. Reduce the costs of pre-contractual opportunism	+	0	0
	6. Do not kill cooperation	-	+	+ +
	7. Motivate long-term concerns	0	+	+
TRANSACTION COSTS	8. Balance the pros and cons benefits of renegotiation	+	0	+ +
	9. Reduce direct costs of contracting	+	+ +	-
	10. Use transparent contracts	+	+	-

4.14   A more detailed assessment is offered in Table 4.4, where we look at the impact of operating, investment and managerial efficiency and the challenges mentioned above. Once again, we see how the stages address the two main introversions of the current regime, the lack of competition and the input orientation. Although a quick look at the

plusses in the table suggests a quick jump to stage 2, the overall social welfare is only maximized if the information is conserved between stages and learning has been effective. An immediate introduction is likely to create restructuring, costly for both the sector and particularly the competitive rents carried by the clients.

Investments and quality

4.15   Lower uncertainty about the future regulation lowers regulatory risk, which increases investment incentives in any given regime. The idea behind dynamic regulation is to clarify not only the current horizon, but also the succession of regimes toward a given goal. As the objective is formulated in output-oriented and competitive terms, both cost-reducing and quality-improving investments are encouraged. Since the cost of capital is set endogenously in the yardstick regime by the level and risk of the firm operations, investments can also be tailored to varying consumer profiles. The prospective opening of the market in the third stage encourages also joint investments with bundled services and other welfare-improving synergies. Also, the orientation on quality rather than cost yields value-added investments profitable as long as the output value is higher than the firm costs. During the transient period of increased competition and cost-orientation, the same precautions for quality skimping as in revenue caps are valid. However, the reform time schedule to output orientation curb the incentives to do suboptimal cost/quality tradeoffs, as they will be costly in the long term.

Table 4.4 Open evaluation of stages.

	Stage 0	Stage 1	Stage 2	Stage 3
Operating efficiency	+	++	++	+
Investment incentives	0, possible ratchet in renewal	+	+	0, harder to predict rents
Investment efficiency	-	+	++, costs are irrelevant	++, costs are irrelevant
Quality impact	KILE	KILE?	++, service focus	++ open service focus
Client involvement	--	-, but improved in anticipation	+	+
Innovation incentives	-	+	++	++
Management involvement	-, defensive	+, choice of regime, internal competition	++, competition for service quality	++, competition for clients
Owners' involvement	-, passive	0, forced to strategy choices	+, stronger incentives for good owners	++, stronger incentives for good owners
Multi-utility provision	-, separation	-, separation	+ , cost irrelevance	++, expected
Bundled services	-, separation	-, separation	+ , cost irrelevance	++ , cost irrelevance
Non-grid investments	-, separation	-, separation	+, on competitive terms	++, negotiable
Accounting investments	+	0, harder competition, but still cost orientation	--, accounting only for internal purposes	--, accounting only for internal purposes
International entry	0, limited interest	0, higher interest in anticipation	+, high interest for over-performers	+, high interest for over-performers

The Rise and Fall of Micro finance: Dynamics in Practice

Consider an example from a different domain: capital markets and financial regulation. In certain developing countries, such as East Africa, the cost of contract enforcement is high due to heterogeneity and corruption.

The local savings and venture market was handled by small informal institutions called micro-finance. By lending money only in small amounts to known families and for specific projects, micro-finance enabled low credit risk in a high-risk environment. However, the lack of financial regulation and insurance blocked entry of larger entities that are necessary in the long-run development of the countries, such as infrastructure and heavy industry. The regulatory vacuum was also used for money laundering and other abuse. Thus, the final vision was clearly defined as a competitive situation with free entry, but strict credit regulation and secure financial transactions.

Unfortunately, some countries applied the IMF vision to rapidly and effectively eradicated the locally adapted micro-finance, only to replace it with Western entrants that responded to the inherent credit risks by starving the local markets for capital. Local banks that potentially could have merged to form viable entities were broken by heavy administrative and regulatory burdens. The social welfare effect was clearly negative for countries that made static moves, whereas the few transition regimes that were imposed showed better development and more active markets, with more competitive conditions, than the original situation. Note that Western investors and banks did not enter in countries under transition where the final goals had not been specified, or where the regulatory credibility was low, e.g., by regulatory capture, political influence and unannounced nationalizations.

5.   A First Proposal

5.01   In line with the stated ambitions, we immediately proceed to a constructive discussion by proposing a concrete example of a regulatory path for NVE. We base our outline on the previously stated operational principle of competitiveness and client-focus as enablers to social welfare and efficiency.

Proposed stages
1)   Competitive menu: ex-ante revenue cap or ex-post cost yardstick
2)   Output competition: ex-post revenue yardstick
3)   Contestable market

5.02   In the following, we briefly describe each stage and its characteristics.

First stage: the competitive menu

5.03   When proceeding from the current situation, the main focus is as mentioned in 4.08 the competitive dimension, e.g. an exogenous, industry-relevant determination of revenues. However, since the first stage marks the transition from an earlier hybrid regime, analyzed in 3.06 and 3.07, two added concerns are added to the criteria for this stage: assessment of firm objectives and regulatory continuity. To make a break with the composite and complex structure of the previous regime, we argue that the first stage should have a simple and easily graspable functional form. In summary, the first stage should clearly signal the irreversible competitive orientation, without penalizing firms with heavy sunk investments and/or non-profit maximizing objectives.

5.04   Literature (Schleifer, 1985, Laffont and Tirole, 1986) and practice (Report AG2/V2 on normative models, Crampes and Estache, 1998, Estache, Klein, 199x) have pointed out the powerful principles behind yardstick competition. In earlier work (Agrell and Bogetoft, 2003a,b), we have also discussed these concepts in a general context. In Agrell and Bogetoft (2003a), it was also argued that an ex-post information assessment of relevant performance indicators supports a policy of higher delegation and incentives. An application of yardsticks to achieve the stated competitiveness could be to regulate the revenue based on a cost yardstick, as below.

5.05   Ex-post yardstick:

R(t) = C(t) + ρ(C*(t)-C(t))

where $R(t)$ is the revenue cap at time t, $C(t)$ is the firm's cost at t (less taxes, charges to superior grids), ρ is the incentive power and $C^*(t)$ is the yardstick cost at t. The yardstick cost is calculated as the *efficient cost* at the level of operation of the individual firm. In practice, the efficient cost can be estimated using simple ratios (future NL regulation), by non-parametric methods taking into account scale and output profile (cf. Agrell, Bogetoft and Tind, 2002), or by adjusted technical norms (cf. project AG-V2). In any case, the yardstick is formed by exogenous observations so that the firm cannot gain on increasing in cost.

5.06   The incentive power $0 < \rho < 1$ is the only discretionary parameter in the regime, giving the percentage of cost-sharing in case of a deviation from the target. Further work is necessary on the exact magnitude of ρ, although some numerical experiments have indicated that incentive powers in the range 30% - 50% are both motivating and balanced. The higher incentive power, the more impact of the yardstick. A low incentive power gives closer fit to the actual cost.

> *Example: The benchmark/yardstick cost for the operation*
> *of a firm is calculated ex-post to C*(1) =100 Mkr for year*
> *1. Assume an incentive power ρ = 50%. The revenues will*
> *now depend on the actual performance so that,*
> *R(1) = C(1) + 0.50(100 − C(1)).*
> *If the firm is 10% more efficient than the yardstick, i.e.,*
> *C(1) = 90,*
> *R(1) = 90 + 0.50(100 − 90) = 95.*
> *If the firm is 10% less efficient than the yardstick, i.e.,*
> *C(1) = 110,*
> *R(1) = 110 + 0.50(100 − 110) = 105.*

5.07   Non-profit oriented firms or firms with large sunk investments may be disfavoured by the competitive yardstick, since they do not necessarily share the same possibilities. To maintain a regulatory continuity, which in the long run lowers the industry-wide risk premium and the regulatory risk, we propose that the first transition stage offer a time-limited alternative for such firms. Once again, in the interest of simplicity and transparency, this regime should be immediately accessible and not distort the choice for innovative and competitive firms. A pragmatic alternative in this sense is the simplest form of ex-

ante revenue cap with an exogenous general productivity factor X, i.e.,

5.08   Ex-ante revenue cap:

$$R(t) = C(0)(1 - X)^t$$

where $R(t)$ is allowable revenue in time t, $C(0)$ is actual cost the base year and X is a general productivity improvement parameter. Further work will be necessary to determine whether a producer price index correction should be applied.

> *Example: A firm has an original allowed revenue*
> *$C(0) = 100$ Mkr. Assume a safety price $X = 2\%$.*
> *The revenues will now be independent of industry costs,*
> *$R(1) = C(0)(1\text{-}0.02) = 98$ Mkr*
> *$R(2) = C(0)(1\text{-}0.02)(1\text{-}0.02) = 96.04$ Mkr*
> *$R(3) = C(0)(1\text{-}0.02)^3 = 94.112$ Mkr*
> *etc.*
> *The regime extracts mechanically 2% of the cap,*
> *irrespective of industry or firm performance. At the end of*
> *the period, say year T, the current cost should not be used*
> *to update the regime, as this reduces the efficiency*
> *incentives.*

5.09   The ex-ante regime offers a clear alternative, a safe revenue with no extra incentives and a general X. By varying the single discretionary parameter X (the same as π in 3.02 above) in a pre-determined manner, NVE can also credibly signal the explicit "price of safety". The firms opting for this alternative abstain from further incentives, but gain time and resources to adjust smoothly to the future regulation. Note that the performances of the firms under this regime are considered when calculating the yardstick cost for the competitive firms, but not the inverse. Also, a firm cannot shift policy during a regulatory period, neither retroactively, which preempts opportunistic choices.

5.10   The arrangement with two distinct choices in the first stage is an example of a *regulatory menu*, which is the topic of the parallel project AG2-V3. Here, it serves a double purpose: to assess the competitiveness of the Norwegian electricity distributors (revealed by their choice) and to create a clearly competitive regime for higher incentives.

5.11   Concerning the length of the stage, we suggest that it be implemented in two regulatory periods of four years. Given the current ownership structure and the novelty of the approach, one period may be insufficient to incite the efficient firms to join the yardstick regime. Two periods will provide positive evidence of the superiority of the yardstick regime to the high-performing firms, while leaving a reasonable delay to undertake necessary restructuring of low-performing firms.

Second stage: Ex-post [final cost] revenue yardstick

5.12   Although offering a predictable, yet competitive environment, the first stage is not a long-run equilibrium. Costs are inherently arbitrary and as discussed at length above under 'Challenges', the maintenance of a cost-based regulation would eventually turn more or less heavy-handed. All to the detriment of the client, who finally just cares about his total bill, including capital costs, operating expenses, profit, etc. To assure long-run operating efficiency, regulatory would also need to outguess the market on a 'fair' rate of return. In doing so, the regulator takes a much larger responsibility for industrial structure, entry incentives and management effort than has been acknowledged. Hence, the second stage has to complement the competitive dimension with a relevant output-orientation. A smooth transition can be obtained by simply reinterpreting the ex-post yardstick from the first stage into final, rather than firm, cost. Here, firms have the possibility to trade-offs between managerial rent (profit) and total cost, which may be in the interest of the clients.

5.13   Ex-post [final cost] yardstick:

$R(t) = P^*(t)$

where $R(t)$ is the allowed revenue at time t, $P(t)$ is the total claimed revenue at time t (less invoicing for generation and transmission) and $P^*(t)$ is the yardstick price/revenue at the same level of output. As with the cost yardstick 5.05, it translates in practice to an annual adjustment of claimed and allowable revenue. The principal difference is that the yardstick is complete ($\rho = 1$), since there is no trade-off between costs and profits. Further work on the modalities of the revenue yardstick (claim periods, taxation, role of the clients) will be suggested in this project.

> *Example: There are three firms on the market with identical service and the revenues 95, 100 and 110 Mkr.*

P(t) =95 Mkr. The yardstick never compares a firm with
its own performance, so the allowed revenues will now be
The revenues will now be independent of industry costs,
R(1) = min (100, 110) = 100 Mkr
R(2) = min (95,110) = 95 Mkr
R(3) = min (95, 100) = 95 Mkr
etc. As shown, only two levels of compensation are active,
the efficient firm, that gets a premium to reveal the true
cost, and the inefficient firms, that get reimbursed with the
efficient level.*

5.14   The second stage is somewhat equivalent to an open market with inelastic demand, where the "market price" is defined by the actors, incentivized by the possibility to align with the "competition". To some extent, this second stage is a more institutional variant of the informal tariff-alignment system that existed before the deregulation. The main difference is now that comparisons are generalized across ownership and geographical region, whereas the previous situation primarily was localized competition. The regime is clear and simple for both clients and firms; the discretion of the regulator is reasonably limited to the important service definition and the incentive power.

5.15   In principle, the second stage could be operated with a parallel revenue cap such as in the first stage. However, since the output oriented yardstick operates on price, rather than cost, the firms that operate under a fixed-price regulation can no longer be used to provide information for the yardstick. This creates an unintended leeway of speculation on the number of firms in each 'market', which is artificial and not welfare improving. Secondly, the existence of a non-competitive alternative in the second stage reduces the incentive for firms to learn and adapt to the yardstick in the first stage, which slows the reform and blurs the regulatory signal. Hence, we recommend that the yardstick regime be mandatory for all firms, irrespective of first-stage choice. Analogously, the second stage is to be introduced equally for all firms, without any transitory regimes or cost-recovery programs (that actually may increase the probability of poor cost-recovery in the second stage by letting firms procrastinate during the first stage).

5.16   The second stage is to run until for a long period with annual reviews, during which NVE must redirect its efforts from cost-analysis to quality performance promotion (corresponds to product safety regulation in e.g. food) and anti-collusion monitoring (corresponds to competition surveillance in competitive markets). Tendencies to

collusion can be remedied by either classical competition law, or by aggressively promoting entry by new operators as a threat. Indeed, economic theory shows that output-based yardsticks with some observability can be made collusion proof under some assumptions. In reality, the high sunk cost and the degree of homogeneity may discourage entry. However, some practical experiences on how to promote long-run renewal of market participants in yardsticks are shared in the report AG2/V2 on the Chilean norm models.
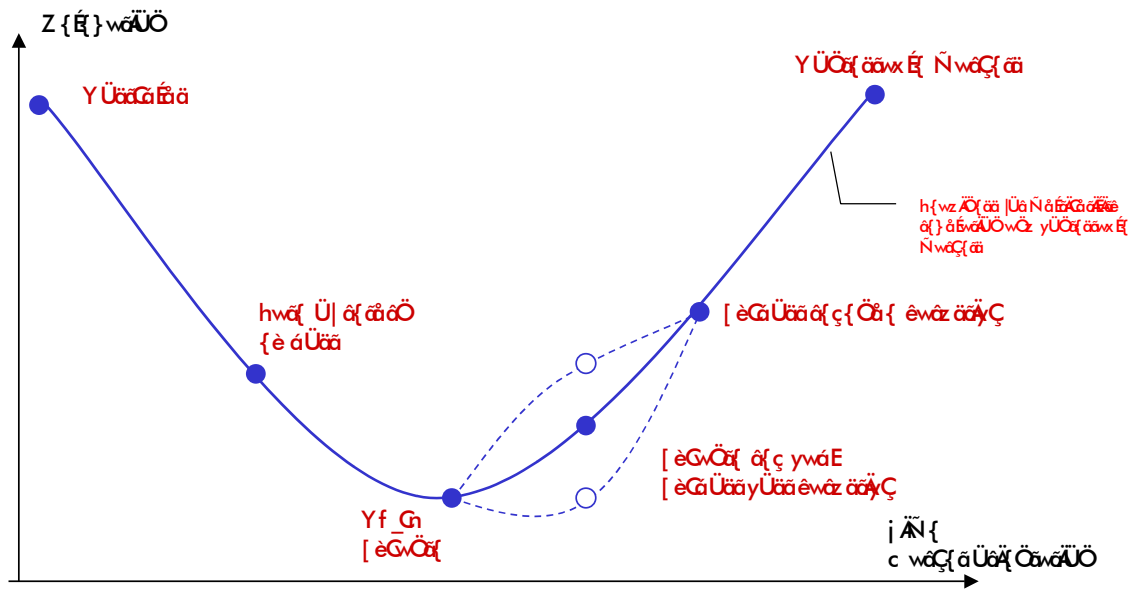
3. Towards contestable markets

5.17   Structural change and technology will finally neutralize the yardstick mechanism in the second stage. In particular, two situations are plausible threats in the long run: collusive agreements through industry concentration and fragmentation through vertical integration. In both cases, the viability of the yardstick regulation would be jeopardized.

5.18   If substantial economies of scale induce a high horizontal concentration in the market, the resulting oligopoly would correspond to the situation on several other sectors (health care, railways, …) where the competition is weak and a yardstick system loses meaning. On the other hand, the concentration also implies a greater capacity to enter in negotiations with the regulator concerning the service and price definitions. Since the regulator maintains the concession rights, the firms might in this case rightfully be charged with higher responsibility to justify their services than in the decentralized case. Stringent anti-trust policies could also contribute to vitalize the competition, but unless there is a credible threat of entry (take-overs), the regulation will necessarily be more light-handed and low-powered. NVE can artificially maintain the number of market actors by refusing to approve mergers, but in reality this would be useless as long as private ownership opens for de facto control of multiple firms. Further studies, perhaps in AG1, could investigate whether such economies of scale are likely to appear, which could also give an indication of the probability of this scenario.

5.19   The other deviation from the competitive situation in the second stage is derived from far driven customer or bundling focus, where the economies of scope far outweighs the scale advantages. Local firms would then arise, specialized in, e.g., urban distribution of utilities, or coastal regions. The scenario is more likely in the advent of distributed generation and/or dramatically increased line expansion charges. Whatever the reason, the market would fall apart

to a potentially high number of actors that to a varying extent interact on other, parallel, regulated markets. Consequently, the determination of a "market price" becomes unviable, since firms no longer share a homogenous service definition (and certainly not a common process). For the urban distributor that negotiates a good contract for simultaneous installation of telecommunications and control systems, the annual network fee can of course be kept lower than for a neighbor that arrives too late for such synergy. The solution for this scenario is within reach and draws on franchising contracts for the regulated services. Here, the advantage of having a well established service definition becomes apparent, as the potential use of the concession instrument.

5.20   The light-handedness prescribed for the third stage is thus not comparable with the current regime in Sweden, neither its prerequisites nor its instruments. The light-handed regime in Sweden is established in an institutional setting where self-regulation is promoted by the threat of intervention. The gradual deployment of regulatory instruments serves here to make this threat credible and enable corrective, preventive action. However, this state of affairs is probably unattainable for the Norwegian sector, where the ex ante policy in effect has established a regulatory prerogative that demands continuity. Firms oriented to external, non-market performance criteria would likely extract excessive rents for arbitrary services, prompting for intervention. We say that regulatory intervention in the pricing process, especially using cost-recovery arguments, is *irreversible*. This does not imply that Norwegian clients would pay more for less service now or in the future, it is merely a question of choosing the correct instruments for the already established dynamics. When introducing the light-handed approach, it is not more controversial than the final stage in any deregulation, when markets have become contestable and regulation shifts focus from process to market functioning.

Summary

5.21   In Figure 5.1 have sketched a three-stage regulatory path in this chapter, using basically two paradigms: competition and client focus. The resulting regimes are modern and powerful, yet surprisingly simple to their structure. Naturally, the crucial point is to anchor the final destination within the regulation, as it determines to some extent the appropriateness of the stages.

Figure 5.1 A Three-stage Regulatory Proposal in a historic perspective[1].

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6.   Synthesis

6.01   The subprojects in AG2 have separately supported the dynamic regulation forwarded in this report. Following the general introduction in FP2, this report provides a concrete direction for a new regulatory paradigm, a modern and innovative view on process and service in the distribution sector.   The main points of this proposal are supported by theoretical and empirical findings, some of which will be summarized below.

6.02   First, the regulatory economists Kahn and Littlechild have both voiced, in different wordings, that the only sustainable regime for natural monopolies is based on market logic. The ideal regulation is thus the mechanism that most closely mimics the signals and incentives of a competitive market. Whereas cost-plus and rate-of-return regulations nowadays are obsolete due to their obvious distortions, the revenue and price-cap regimes enjoy a popularity that risks being temporary. Already Williamson (1976) pointed out that high-powered regimes that are based on periodic contracting either are lagged rate-of-return regulation, with its distortion to efficiency and investments, or excessive rent transfers to firms, with the entry-deterring distortions that this entails. Remains the yardstick principle, where firms' revenues are set endogenously in the market. The work in AG2/V2 shows the feasibility and attractive properties of such regimes. However, yardsticks are as dangerous as they are powerful and must be treated with the respect they demand. The definition of the service must be anchored and established, the contractual obligations and rights of the firms must be defined and there must be a critical number of actors in the market. This observation naturally leads over to the issue of regulatory continuity.

6.03   Second, recent empirical and theoretical by Estache et al. (2003) and Vignolo (2001), among others, highlight the importance of regulatory continuity, independence and transparency to minimize motivation and transaction costs. With private ownership, every shift in regulatory policy is likely to entail reactions in the cost of capital, rate of innovation and management involvement. History has shown the dynamics of regulation and deregulation to follow more or less planned cycles. Our idea in this report is to draw on the results for regulation as a discovery process (Weisman and Pfeifenberger, 2003) and classic theories of bounded rationality (Simon, 1954) to guide

and control the route to social welfare optimization and the implementation of pseudo-competition.

6.04   Third, the mechanisms proposed in this study are not the result of cherry-picking in the regulatory hall of fame. Based on an analysis of past, dynamically irreversible, decisions the portfolio of relevant instruments is limited. The menu arrangement in the first stage is intended to validate the important behavioral prerequisites for the upcoming stages. In doing so without jeopardizing the long-term direction, NVE shows its unconditional support for the reform policy without sacrificing the captive industry. The work in AG2/V3 demonstrates and justifies the choice and mode of menu operations in this approach.

7.   Further Work

7.01   Given the limitations of time and resources in the current stage of the reform process, we have been forced to leave some work to posterity. The further projects follow the logic outlined above in that more detail is required for the immediate stage, while strategic issues for the future are addressed in parallel. It is, in our opinion, inappropriate to rush the development of future stages or to neglect the important strategic issues for hypothetic and futile projections of future parameters.

Yardstick issues

7.02   The yardstick regime is a concrete and natural idea, but careful analysis must be made using Norwegian data to illustrate the outcome. Although we primarily have intended a frontier-based yardstick, the exact definition is outside the scope of this work. Analogously, NVE scarce resources in the latter phase of this project have not been available for any consequence analysis using Norwegian data. Having performed such analysis on Swedish data in Agrell, Bogetoft and Tind (2002), we are nevertheless assured in the feasibility of such analysis and the approach. We suggest that the definition of a yardstick project should be subject to the principles outlined in this report and in the AG2/V2 norm model project. Although we advocate the further development of a DEA-model for the yardstick, we acknowledge that arguments can be found also for other norm models, including simpler yardsticks based on zoning.

Menu design

7.03   The parameters and procedures for the implementation, updating and operation of the first stage menu should be investigated using theoretical and practical arguments. The fundaments of a regulatory plan should be formulated, outlining how the elements fit together and how information can be disseminated on the reform.

Consequence analysis

7.04   Once the yardstick model and the menu system have been outlined, it is time to make serious consequence analysis, preferably using the

existing Norwegian data, in order to calibrate technical parameters in the system.

Service definition

7.05   In order to render the output-orientation credible in the second stage, a project should be looking at a useful and unambiguous definition of the services that a distributor is expected to deliver. This includes, but is not limited to, a discussion of universal service obligation, quality standards and connection fees.

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