# POSTMODERN POWER

**The cultural shift in electricity system building at the turn of the millennium**

by

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## 1. The great stagnation

It was a beautiful morning in October 1985 somewhere amidst the famous Swedish archipelago. The sun was just rising over the Baltic Sea when the President of IAEA, Hans Blix, approached the idyllic peninsula of Simpevarp in his black car. At a first glance everything looked as expected: straight ahead he could clearly discern the recently completed nuclear power plant with its technologically disciplined façade, and nearby were as always the picturesque red cottages in Simpevarp village. But – there was also something more in sight, something that did not really seem to fit into the overall picture: on the territory of the nuclear power plant a huge *circus tent* had occupied the ground!

The circus on Simpevarp peninsula was not of the usual kind. The funny-looking tent had been risen to accommodate the guests that were expected to the nuclear power plant this day, which was namely its greatest day ever: the time had come for the official inauguration of "Oskar III", the last and the largest nuclear power reactor, not only on Simpevarp peninsula, but in all Sweden. 1,050 MW was its electrical effect, more powerful even than the legendary Harsprånget hydropower plant far up in Northern

Sweden. 11 billion Swedish crowns was its price, and its career as a commercial provider of electricity was now to start.

Hans Blix was invited as the main speaker at the inauguration ceremony, and similarly to a number of representatives from OKG (the owner of the power plant), Asea-Atom (who had delivered the technology) and guests from the European nuclear power industry, he pointed in enthusiastic words at the importance of nuclear power and its role for Sweden's and the whole world's energy supply – now and even more in the future. To be sure, it was well-known that the Swedish Parliament five years earlier had actually decided to completely abandon nuclear power as a source of energy in Sweden by the year 2010, but in autumn 1985 it still seemed very uncertain as to whether this would really happen. The social democratic government, headed by Prime Minister Olof Palme, had not yet presented any concrete plan for the decommissioning, and OKG President Lennart Fogelström already spoke about the possibility of yet another giant reactor on Simpevarp peninsula.[1] In the eyes of nuclear power proponents it seemed difficult to understand how it would be possible to shut down all nuclear power plants in a time of continuing rapid increase in the demand for electricity.

It was a joyful celebration at the 'circus' on the Swedish coast, champagne was flowing and the Swedish electricity system stood at its very height, self-confident and as always ready for new challenges.

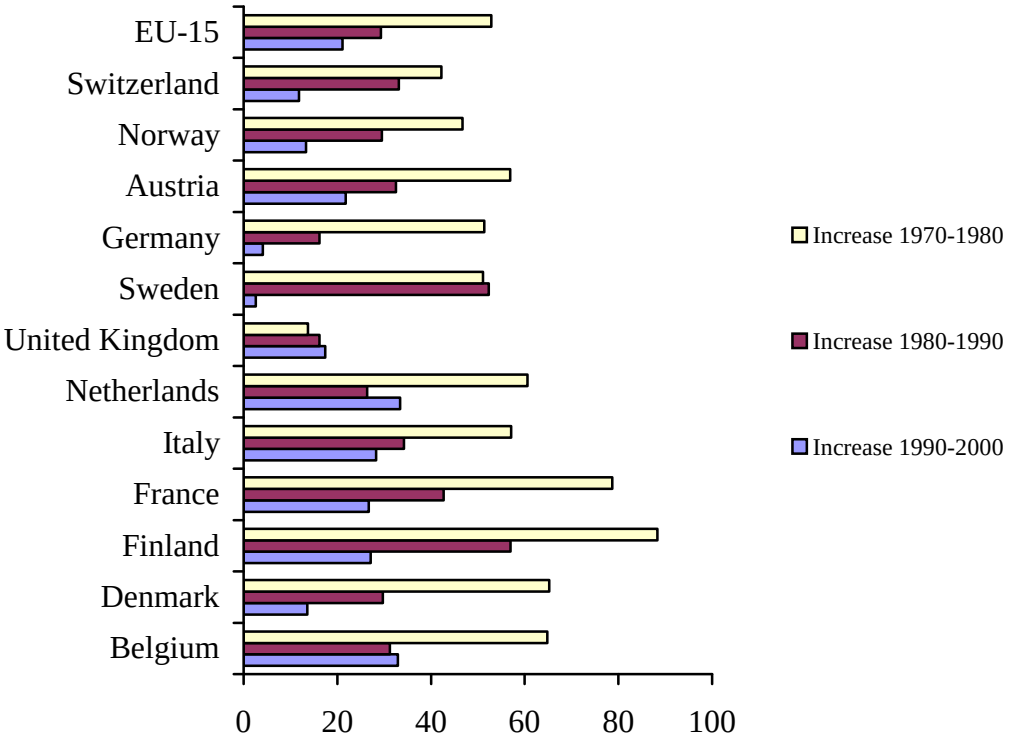
With hindsight, however, the inauguration of 'Oskar III' was to appear as a turning point in the history of the Swedish electricity system. The Simpevarp circus was to be the last one of its kind for the following decades in the Swedish electricity business. In contrast to the previous hundred years, during which large power plant inaugurations had been very frequent, no larger power plant would from now on be built at all. And as a matter of fact, further power plants would not be needed. The reason was that the previously exponentially increasing electricity consumption in the country from now on turned into stagnation. In contrast to the past, when the use of electricity had been roughly doubled every twelfth year, the demand for electricity was from now on to remain more or less constant for the foreseeable future.

In European perspective, the Swedish stagnation in electricity consumption from the second half of the 1980s was in its extremeness not typical. Especially in the South European 'cohesion countries', along with Ireland, electricity consumption continued during the rest of the millennium to grow in an impressive, exponential way. This obviously reflected the lagging industrialization process in these parts of Europe. Other, economically more advanced nations, such as France, Italy and the Benelux countries, did show a decline in consumption growth, albeit in a more modest way than Sweden. On the other hand, countries such as Norway, Denmark, Switzerland and Germany all seemed to follow the Swedish pattern of rapid stagnation, with growth rates sinking to slightly more than 1% per year during the 1990s. At the level of the EU as a whole, the growth in consumption decreased from around 5% per year in the 1970s to 3% per year in the 1980s and 2% per year in the 1990s. Moreover, on the other side of the former Iron

[1] See e.g. *Affärsvärlden* 1986, no. 17, p. 16.

Curtain, the collapse of the Central and East European socialist economies in 1989-91 led to a dramatic absolute decline in electricity consumption in these countries.[2] All in all, at an aggregate level, both Eastern and Western Europe experienced a clear decline in consumption growth during the last decades of the 20th century.

***Figure 1. Growth rates of electricity consumption in Northern and Western Europe, 1970-2000 (percent).***




Källa: IEA, *Energy Statistics of OECD Countries*, 2005.

In this chapter I will take the statistical observation of stagnation in the European electricity sector as a point of departure for investigating the extent to and ways in which this stagnation contributed to reshaping the style of system-building in the European electricity sector. I will draw on qualitative evidence mainly from those countries that have experienced the most dramatic stagnation, with the argument that these can be regarded as forerunners for a new system-building culture which in the 'information age' can be expected to spread to the level of Europe as a whole within a foreseeable future.

The chapter will thus investigate how the electricity systems in countries of stagnation responded to the new situation, with no or negligible growth in electricity consumption. I will show that this material stagnation meant an end to the traditional logic of system expansion in electricity, and that actors were instead forced to seek – and invent – new mechanisms for generating growth. We will show that this, in turn, led to – or was conditioned by – a far-reaching *cultural shift* within the electricity industry, a shift which

[2] In the former USSR, electricity consumption declined by 41% from 1990 to 2000. Cf. IEA, *Energy Statistics of Non-OECD Countries, 2003-2004*, p. II. 520.

also fundamentally transformed the institutional and discursive dynamics of transnationalism in electricity.

## 2. Large technical systems and the end of history

The great stagnation did not come as a surprise to system-builders and other actors within the electricity business. It was well-known that the steep growth experienced during the preceding decades would not be sustainable on the long term.[3] Actors expected a slowdown in growth for quite simple reasons: electricity systems in heavily industrialized European countries seemed after a century of intense expansion already to have conquered the possible markets for electricity.

The history of electricity had started with its use for the purpose of lighting and motion power and had thereafter continued in the direction of cooking, heating and other uses. At the same time, the new technology spread rapidly to more and more industries and households.[4] With LTS terminology, the systems had during most parts of the 20th century experienced an intense growth phase, whereby growth was the result both of the system's geographical expansion and of its conquering more and more of its 'environment'.[5] But towards the 1980s it started to become obvious that the main part of growth had already occurred in the most advanced European countries and that the system was thus heading towards a consolidation or stagnation phase,[6] with no or negligible growth and where the system's developmental opportunities had more or less been emptied.[7]

At a first glance it therefore seemed that the system and its actors from now on were destined to enter a boring and non-dynamic electricity world, without growth or expansion. Especially the Swedish, the German and the East European electricity systems, with their sudden and radical stagnation almost simultaneously from around 1988, seemed in an almost caricature-like fashion to illustrate the American philosopher Francis Fukuyama's controversial thesis about the 'end of history', which appeared in the global societal debate at about this time.[8]

How can we understand such a situation? In past decades an impressive amount of books and articles have been written about how electricity systems – and other socio-technical systems – have been created, how they have developed and grown and contributed to

[3] This is easily recognizable in a variety of documentary material from this period, such as the annual reports of large electricity companies.
[4] E.g. Arne Kaijser, *I fädrens spar: Den svenska infrastrukturens historiska utveckling och framtida utmaningar* (Stockholm, 1994), p. 160ff.
[5] Cf. Thomas P. Hughes, 'The Evolution of Large Technological Systems', in Wiebe Bijker, Trevor Pinch and Thomas P. Hughes (eds.), *The Social Construction of Technological Systems* (Cambridge, MA, 1987).
[6] Hughes distinguishes between the following phases: invention, development, innovation, transfer, growth, consolidation, stagnation.
[7] However, many electricity companies were – and still continue – dreaming about conquering the transportation sector, as illustrated by the participation in electric car R&D projects and recently also fuel cells.
[8] Francis Fukuyama, *The End of History and the Last Man* (London, 1992).

societal development and economic growth, how they have improved our lives and made things easier. Fantastic stories have been told about system builders and other heroes, who through their creativity and diligent work have contributed to transforming society and reshaping the world. From this perspective it comes perhaps as a surprise to the reader that the present chapter expresses a desire to tell a story about electricity systems in a time when the system's growth and expansion ingloriously *stops*, wishing, as it seems, to tell the history of electricity beyond history's end.

The stagnation phase denotes in traditional LTS research a kind of end point for a system's development, that is, the system's actual history has through the coming of stagnation, roughly speaking, already been played out. The heroic build-up process of the system comes with stagnation to an end, and system builders can be expected to be replaced by much less dynamic, predictable system administrators. In this perspective it is tempting to ask oneself whether there is at all anything important and interesting to tell about a system beyond the horizons of exponential growth. Is the world that starts there really anything that a historian should and could deal with?

In general it can be seen that historians – and in particular historians of technology – have answered this question with 'no'. The history of systems has nearly always been viewed as a history of invention, innovation, development and expansion. But if we look more closely at previous research on sociotechnical systems, it seems, as a matter of fact, that the understanding of the stagnation phase as an 'end point' in a system's history, has more to do with a general lack of interest in this phase, rather than with any real insight into what actually happens when growth slows down and expansion stops. Practically all earlier studies of sociotechnical systems have mainly focused on their creation, build-up and development, rather than on their stagnation and *interrupted* growth. It is utterly rare to see any deeper studies that have tried to answer the question about developmental phases beyond stagnation. Obviously, the Hughesian view on sociotechnical systems and their dynamics need to be revised in this respect, if we are to get a better hold of the object of our interest.[9]

This paper intends to contribute to such a revision of LTS theory, showing that the stagnation phase in the history of electricity systems paradoxically became a phase of unexpected dynamics and turbulence. How and why that is possible will be outlined in the following.

## 3. Whither electricity in the information age?

To better understand what happens in the stagnation phase, let us here first of all broaden our scope and discuss electricity in relation to the historical period at focus, i.e. the late 20$^{th}$ century.

[9] Among the few studies that have taken an explicit interest in the stagnation process of systems is Tomas Ekman's PhD dissertation on trams in Stockholm, *Spår i vägen: teknikval, politik och spårvägstrafik i Stochkolm 1920-2002* (Stockholm, 2003).

It is interesting to note that the great stagnation in electricity consumption in large parts of Europe coincided with a number of significant trend shifts in European society. In particular, it appears highly relevant to discuss the changes in the electricity sector in relation to the 'third industrial revolution', i.e. the rise of the information society. The remarkable growth of European electricity systems during the 20th century was intimately related to the 'second industrial revolution'. Electricity systems were central in the economic and societal development that followed from the end of the 19th century, as electric power together with the combustion engine literally became the driving forces in societal transformation.[10] In many countries the electricity sector developed in close symbiosis with the emergence of electricity-intensive mechanical and process industries, which became the very basis for the industrial economy in countries such as Sweden, Finland, Germany and the Soviet Union.

But from the 1970s and onwards new technologies and new industries entered the stage, especially as a result of a number of radical innovations within the field of microelectronics and informatics. Initially these innovations were hardly noticed at all in economic statistics or in people's everyday lives. But as the industries of the second industrial revolution were squeezed into a far-reaching structural crisis, a number of new 'development blocks'[11] were gradually formed within fields such as digital telecommunications, information technology, pharmaceuticals and knowledge-intensive services. These development blocks would with time gravitate towards the very core of the economy and society.[12] Here the electricity sector could no longer play any central role, and the growth of the new economic sectors did therefore not necessarily lead to any spectacular growth chances within the electricity industry itself. In this perspective the great stagnation in electricity consumption towards the end of the 20th century can be regarded as a quite natural aspect of a far-reaching economic and societal structural transformation.

The information technology revolution also opened up interesting perspectives concerning the *governance* of electricity systems. Traditionally, there had been agreement among actors in the electricity sector concerning the need for a *central regulatory function* in the system, since it would otherwise have been virtually impossible to handle the enormous amounts of information that circulated in the system. The rise of cheap microelectronics in the 1970s and 1980s changed this. Still in the 1970s most actors would have argued that a decentralization and deregulation of the electricity market would – for mere technical reasons – have been virtually impossible. In particular it would hardly have been possible to create a 'spot market' for electricity.[13] But these obstacles were now silently removed. For the first time in history, it became technically imaginable to create a more decentralized system where electricity could be traded more or less like any other goods. Information technology made it possible to simulate a 'free

[10] E.g. Lennart Schön, *En modern svensk ekonomisk historia: tillväxt och omvandling under två sekel* (Stockholm, 2000).
[11] Cf. Erik Dahmén, 'Development blocks in industrial economics', *Scandinavian Economic History Review*, vol. 36, 1988, no. 1.
[12] E.g. Schön, chapter 6.
[13] This is pointed out by several interviewees.

market' for electricity and hence separate that market from its previously very close relation to the technology itself.

The idea of a free, decentralized market for electricity is particularly interesting if seen in relation to the overall political trends in the world during the 1980s and 1990s. The 1980s became in the first and third worlds a decade dominated by the new political approaches of Margaret Thatcher in the United Kingdom and Ronald Reagan in the United States, while at the same time neo-liberal economic theories got a strong foothold within powerful international organizations such as the World Bank and the International Monetary Fund. On the European continent, the situation was somewhat more ambiguous than in the Anglo-Saxon world, although countries such as Germany, the Netherlands, Belgium and Denmark were characterized by strong centre-right governments in office during these years. Even in a country like Sweden, with strong social democratic welfare traditions, the neo-liberal ideas flowed without any greater difficulty into the ministries of finance and industry, where a number of young ambitious economists worked as expert advisers.[14]

More importantly, however, the Commission of the European Communities, as a crucial supranational organization, developed in the mid-1980s to become a truly visionary force concerning its neo-liberal striving for institutional change in the sign of deregulated markets.[15] This was so despite the fact that the commission since 1985 was headed by a socialist, the Frenchman Jacques Delors. The liberal market economy-oriented thinking in Europe experienced another upswing following the collapse of the communist regimes in Central and Eastern Europe from 1989.[16] Naturally, these countries were in the 1980s slower in adapting to the new climate, but once they did so after the revolutions of 1989-91, they adopted the new neo-liberal principles with greater enthusiasm than anybody else.[17]

The electricity industry did not stay aside this ideological shift: economists started to ask themselves – and politicians – why the neo-liberal principles could not be applied to the electricity sector, especially so in an era of ever more advanced information and communication technologies. There was an increasing interest in adapting traditional electric utilities, which in many countries had had special organizational forms, to the forms and styles of 'normal' business firms. There was also an increasing interest in the competitive mechanisms of the capitalist market economy and in finding ways in which such mechanisms could stimulate the electricity business.

Yet another aspect that needs to be taken into account is the *intensifying globalization* of markets and industry during the 1980s and 1990s. The technological developments within

[14] Per Högselius and Arne Kaijser, *När folkhemselen blev internationell: elavregleringen i historiskt perspektiv* (Stockholm, 2007), chapter 3.
[15] The EC visions were put forward in a though-provoking 'working document' in May 1988, *The Internal Energy Market.*
[16] Hence Sweden, for example, got a right-wing prime minister in 1991 – for the first time since over 60 years. In Germany, the government of Helmut Kohl seemed to be 'saved' from a loss in parliamentary elections by the collapse of GDR.
[17] Cf. the 'shock therapy' political approaches in, for example, Estonia and Poland.

microelectronics seemed from the 1970s to accelerate the revolution in transport and communications that had taken off already following World War II. This created new and above all cheaper opportunities for building and coordinating global networks within and between corporations and economies. The result was an enormously strong trend towards internationalization of business activities in Europe and rapidly growing world trade and international investment. Economic policy did its best to adapt to these changes. The strongly export-oriented economies in countries such as Germany, the Netherlands and Sweden were drawn into this development and profited enormously from it, while at the same time globalization created an unprecedented competitive pressure from countries in Asia and elsewhere.[18]

With time, the intense expansion abroad by West European industrial companies also inspired the electricity business, which had so far been almost completely national (or sub-national) in its scope. The internationalization of electric power companies started to grow exponentially already in the 1980s through consulting and related activities in Asia and elsewhere. The neo-liberal economic climate opened up opportunities for investment in the third world, where some countries aimed to boost their nascent electricity systems through privatization. The size of these activities were still small compared to the safe domestic electricity sales, but the overall positive trend was promising.[19] The inspiration from successful multinationals in 'normal' sectors was obvious: if those companies had proved so successful in their international expansion, would then not also electric utilities, with their highly advanced competencies in a number of fields, be able to compete on the globalizing electricity markets? Growth through internationalization seemed to hint at a way for electric utilities to continue growing even in times of domestic stagnation in electricity consumption.

From a structural perspective, the above arguments can be summarized as follows:

- The microelectronics revolution together with the increasing interest in neo-liberal economic policy seemed from the mid-1980s to point in the direction of *liberalized* and *deregulated electricity markets*, aiming to bring electricity more in line with the principles of 'normal' industries;
- At the same time, globalization and the (actual or expected) stagnation in electricity consumption domestically seemed to point in the direction of an increasing strive for *internationalizing the electricity business*.

All in all, becoming more and more embedded into the third industrial revolution, European electricity systems experienced an increasing transformation pressure which from the mid-1980s became increasingly acute. Let us in the following turn to the issue of how this transformation pressure pushed for a shift in the logic of system-building.

[18] E.g. Schön, p. 515.
[19] Högselius and Kaijser, chapter 6.

## 4. Towards a new logic of system-building

At a first glance, the consolidation and stagnation of a large technical system might, as indicated in the preceding section, seem to imply that the function of system-building becomes obsolete, outdated and meaningless. The end of the growth phase of the system might indicate that there is nothing to build anymore, that everything has already been constructed and that the system is recognized as more or less 'complete'.

This view, however, neglects the fact that electricity systems are not technical, but rather *socio*-technical creations. This means that 'system-building' cannot be interpreted merely in material-technical terms, but rather includes a variety of organizational, institutional, discursive and other social transformations. From this perspective, system-building does not necessarily 'stop' following the material stagnation in electricity consumption from the mid-1980s. As will be discussed in the following, the actors in the system rather shifted their emphasis towards a strongly *non-technical* type of system-building.

There were two categories of actors that were particularly unwilling to accept the 'completeness' of electricity system-building towards the end of the millennium. These were *public policymakers* – at national and European levels – and *large electricity companies*.

Public policymakers, inspired both by the IT revolution and by the new neo-liberal political fashions, acted in a way that revealed a dissatisfaction with the organizational and institutional form of the existing electricity system. Traditionally, electricity had been viewed as a very special good that in its sophistication regarding production and delivery required a very special supervision by the state, especially during the build-up phase. In particular, this had made the 'normal' capitalist market mechanisms appear inappropriate for the electricity business. In the neo-liberal era, however, this view started to be challenged, and an alternative was proposed: the electricity business should be made to resemble a free market economy to the greatest possible extent. All electricity supply, according to this vision, should be subject to the principles of the free market, with efficiency guaranteed not through state-led, centralized steering, but rather through competitive rivalry among business firms. The vision was in essence one of a 'de-technified' electricity system, i.e. a system where the complexity of the material infrastructure did not prevent a 'normal' market from forming and where prices were not determined on the basis of costs, but solely on the balance between market supply and demand. With an infrastructure that was basically already in place and with advanced information technology, it would, so to say, be possible to liberate electricity from its technological prison, which for a century or so had been an 'excuse' for treating electricity in a 'special' way. The new vision paved the way for far-reaching institutional developments in the 1990s.

In the first countries that underwent 'deregulation', England and Norway, the need for institutional transformation was formally motivated by obvious problems in the way the traditional electricity market functioned. In other countries that soon followed, particularly Sweden and Finland, broader economic problems became the trigger for

actual reforms. At the level of the European Communities, where the EC Commission, as noted above, became a driving force in electricity market reform, a main argument for deregulation was the need to strengthen European competitiveness against other parts of the world. For example, it was expected that deregulation had the potential to increase Western Europe's GDP by 0.5%.[20]

What the EC Commission imagined was a transnational linking of regulatory frameworks among the member states. Common rules should be developed, and the electricity networks of individual countries, which were in most cases already physically linked to each other, should form the basis for a 'single market' for electricity. The idea was further supported by linking it to the Trans-European Networks programme that was launched in the late 1980s, and whose energy component included an ambitious plan to strengthen the physical links for transmission of electricity across national borders.[21] In principle, however, it was imagined that the 'single market' for electricity could largely be established on the basis of already existing links, and the main challenge was therefore of institutional rather than material nature.

For different reasons, the pace of institutional reform slowed down within both Western and Eastern Europe from the mid-1990s. For example, in the former socialist countries of the Baltics and Poland, which were governed by strongly neo-liberal governments in the early 1990s, it had been imagined that electricity markets would be deregulated and the electricity companies themselves privatized. But towards the end of the 1990s this process was either cancelled or strongly delayed due to failure to come to any broad political consensus. Germany, for its part, seemed to take the East-West reunification as an excuse for not dealing with the transformation pressure at the political level, so that the old regime basically remained in place until the liberal-rightwing government in 1998 liberalized the electricity market in a half-hearted way. In France, the issue of deregulation and liberalization was already from the beginning unpopular with both policymakers and the electricity industry, with sentiments going back to World War II and arguments raised for a priority of security of supply issues over the economic logic of market efficiency.[22]

In Brussels, the European Commission was for its part forced to take step back as a result of strongly anti-liberal lobbying from some countries and in particular from Eurelectric, a branch organization that was formed by dominant utilities within the EC for this purpose. The far-reaching reforms proposed in the years around 1990 melted down to a decision in 1996 to only very slowly open up the single market for electricity.[23] Despite the slowdown in the pace of institutional reform, however, it seemed obvious that it would only be a question of time before the new, free market-oriented structure would be in

[20] EC Commission, *The Internal Energy Market*, p. 6, §19.
[21] See e.g. European Commission, *Report on the implementation of the guidelines for Trans-European Energy Networks in the period 1996-2001*.
[22] As pointed out by e.g. Bo Källstrand, manager at EdF with responsibility for internationalization issues (author interview).
[23] Directive 96/92EC, 19 December 1996, see especially Article 19.

place, and most actors therefore started to prepare themselves in various ways for an expected liberalization.

The large electricity companies, for their part, were initially far from enthusiastic about the proposed liberalization of electricity markets – at least not in their home countries. On the contrary, they felt directly threatened by the institutional trends, since it implied that their secure markets for selling electricity were not to be so secure anymore. But this threat spurred them the more in trying to make reality of the great vision that was gradually formed from about the mid-1980s: to escape from their stagnating and claustrophobic domestic markets and rush out to other parts of Europe and beyond, integrating themselves into the electricity systems of other countries and thus heading for continued firm-level growth.

Especially the collapse of the socialist regimes in Central and Eastern Europe tended to accelerate the trend towards an internationalized European electricity system. Financially powerful companies such as the German regional utilities and the French giant EdF, but also the somewhat smaller Nordic utilities Vattenfall and Imatran Voima (later renamed Fortum), headed for the East. Hungary, in particular, became an early show-case for the opportunities of Western investment in the East.[24] In East Germany, by contrast, internationalization was retarded due to a controversial deal among the three largest West German utilities RWE, PreussenElektra and Bayernwerk to take over the East German electricity system, i.e. an intra-German solution. In many other Central and East European countries the internationalization process was slowed down somewhat in response to emotionally controversial issues of privatizing what was regarded as nationally important assets.

But the West European electricity companies also started to enter each other's home markets. The UK market was opened up for foreign ownership already in the late 1980s in connection to the institutional reforms there. It attracted above all American electricity companies, but also smaller players such as Finland's largest utility IVO saw a chance to expand. In 1990 the large German utility PreussenElektra became the first foreign player on the Scandinavian electricity market through a cooperation agreement with Sweden's second largest electricity company Sydkraft. In general, the expected institutional reforms in Sweden and Finland, which took place earlier than in many other European countries, led to a great interest among foreign players for these markets. The largest Swedish and Finnish utilities, Vattenfall and IVO, respectively, invested in its each other's home markets and by 2002 the Finns had even taken total control over the Stockholm municipal utility. Vattenfall, on the other hand, grew in exceptional terms through foreign expansion starting in 1999. The Swedish company took control over the municipal energy providers in Hamburg, Berlin and Warsaw as well as the whole of East Germany (following a geographical path that seemed to have some parallels to the Swedish military expansion in the great wars in the 17$^{th}$ century!). The Swedish expansion, in turn, was actually enabled as a consequence of far-reaching mergers and acquisitions on the

[24] Western electricity companies that entered the Hungarian market included, among others, EdF, RWE, PreussenElektra, EnBW and Electrabel.

continent, as the cartel authorities did not allow the large German utilities to keep their control over the former GDR.[25]

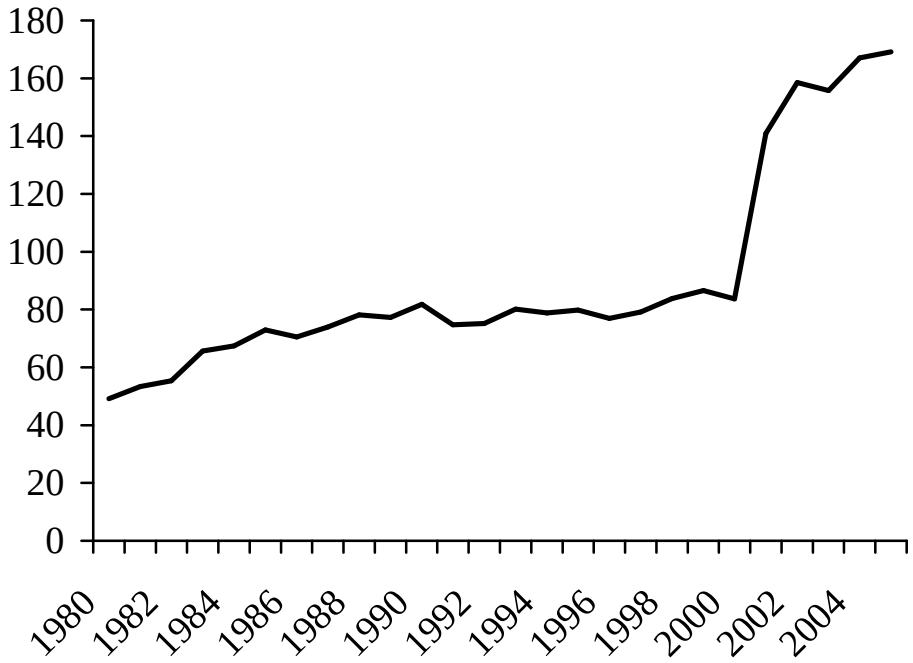
Of course, the regulatory transformations and the internationalization of the large electricity companies in Europe from the late 1980s were not the only developments that took place in the European electricity system during these years. At the European level, the Trans-European Networks programme has already been mentioned as an example of a more 'material' transnationalism that evolved during the same time, and this was complemented at the level of individual countries through the construction of new technical system components such as power plants, transmission lines and IT systems, as well as the removal of technical components in connection to, for example, the decommissioning of old power plants. Such material activities continued to a certain extent even in those countries that experienced the most dramatic stagnation in the demand for electricity.

However, compared to the far-reaching institutional reforms and the roaring internationalization of the large European electricity companies, the technical-material developments appeared almost negligible. From this perspective, it can be argued that system-building in electricity from the mid-1980s proceeded mainly in terms of *regulatory transformations* and *firm-level internationalization*, rather than in terms of material expansion or growth. The transformation of electricity as a socio-technical system had only very little to do with the physical interconnections across European borders, but was almost totally an organizational and institutional process. It was above all through a wave of mergers and acquisitions as well as an increasing Europeanization of rules that European electricity systems in the 1990s were more tightly connected to each other. The cross-border European integration of electricity systems along these lines was later also discursively expressed through a series of name changes: by 2006, a whole series of traditional, century-old names of electricity companies such as Sydkraft, Stockholm Energi, Hamburgische Electricitätswerke, Berliner Kraft- und Licht AG, Warszawskie Elektrocieplownie etc. had disappeared forever. Instead, these and many other companies had completely adopted the names of their foreign owners.[26]

The transformation meant that a new interpretative flexibility appeared in defining the geographical boundaries of European electricity systems. Many actors started in the 1990s to regard themselves as players not only on their domestic markets, but rather on the European or even global arena. This meant that from the perspective of these actors, national borders ceased to function as natural *system boundaries*. For them the system was now, instead, delimited by a much wider system boundary – or by no boundary at all. For most large electricity companies this reinterpretation of the electricity system from national to international meant that new growth opportunities were created – despite domestic stagnation. By widening the boundaries of the system, new growth could be achieved. In contrast to the stagnating demand for electricity, an internationalizing company such as Vattenfall could thus head for an impressive growth also beyond domestic stagnation, as seen in figure 2 below.

[25] Högselius and Kaijser, chapter 6.
[26] Ibid.

***Figure 2. Vattenfall's electricity production, 1980-2005 (TWh).***




*Source*: Vattenfall annual reports.

The dynamics of growth, however, was now of a totally different kind. The expansion was not anymore 'organic' in the sense that the system could grow through exponentially increasing consumption and the continuing addition of new power plant and other technical components, as had been the case during most part of the 20th century. Instead, the new growth followed the non-technical logic of 'financial engineering', principally in the form of mergers and acquisitions. It was a type of growth that was based on the destruction of national boundaries of electricity systems through financial transactions and organizational re-engineering. The noteworthy aspect of this is that it could happen without any substantial changes in the systems' physical-technical components (the exception was the emergence of a couple of new transnational cables, but it is actually fully imaginable that the utilities' rapid expansion abroad could have taken place even in the total absence of physical transmission facilities across national borders!). The transformation was organizational and institutional – and also 'mental' or 'interpretative', because it was to a great extent exactly about 'forgetting' the century-old idea of national systems, and head for learning to view the electricity system as something beyond the nation.

It is hardly surprising that such a transformation demanded a far-reaching cultural adaptation among system-builders. As a matter of fact, it seems that no far-reaching foreign expansion was possible until a *generation shift* among top-level managers had been pushed through. The old generation's opposition against such a generation shift in many cases seems to have postponed the internationalization process. The situation is paradoxical in the sense that it was the old generation of managers that was actually the

ones pushing for far-reaching change within the old system, but who later appeared to be totally incapable of facing the actual consequences of the new, non-technical style of system-building. The old generation turned out to be prisoners of their own culture, which proved unable to cope with transnational linking beyond the traditional European model of exchanging electricity across borders on the marginal. They had great difficulties to grasp the new logic of electricity systems that could actually be interlinked much more powerfully in organizational and institutional terms, rather than in technical-physical ways.[27]

The new generation of managers that entered electricity companies towards the end of the millennium was often completely new to the electricity business. They had typically a background from those large export-oriented industrial companies that had grown considerably through internationalization during the preceding decades. For example, the Swedish electric utility Sydkraft was from 1990 headed by Göran Ahlström, who had made his career within the large Swedish steel company Sandvik, whereas Lars Josefsson, who as CEO of Vattenfall was responsible for that company's radical expansion to Poland and Germany, had previously worked at the telecommunications company Ericsson and the military industrial company Celsius. In Finland, the largest utility Fortum was headed by Mikael Lilius with a background from the medical technology company Gambro. These persons had no substantial previous experience with the electricity business or with the corresponding technologies – a situation that would have been unimaginable just a decade earlier. On the other hand, they did possess skills and competencies that were of uttermost value for system-building in the new electricity era, in terms of experiences from successfully internationalizing businesses in other sectors of the economy.[28]

## 5. Postmodern power

Looking back upon the 20th century, electricity systems in Europe were during most of this century first and foremost characterized by an impressive *expansion* in a variety of dimensions, with exponentially increasing production and consumption of electricity. System builders lived in a world where they got used to doubling the available production capacity every 10-15 years, while constantly fighting to conquer new environment in different uses, starting with lighting and power and moving towards areas such as cooking and heating. With increasingly efficient production of electricity and sinking tariffs, electricity could enter a variety of new uses.

It was during this long period of time quite natural for actors in and around the electricity system to establish a system building culture in which they regarded themselves as key actors not only for electricity networks per se, but also for the entire construction of modern European nations and societies. By 'culture' I here mean the established ways to materially, institutionally and discursively carry out various activities in the system, especially in relation to the system's evolution over time. Electricity system building culture came in this sense to share many characteristics with the culture of European

[27] Ibid.
[28] Ibid.

nation-based industrial societies at large: the electricity system was characterized by long-term planning, centralization, bureaucratization, strong goal rationality and a self-evident belief in politics as an instrument to govern and transform society. Above all there was a strong belief in technical and societal 'progress' as an overarching ideology: electricity system building was about creating a better world, making life more comfortable and people happier with the help of new technology. Often the very rise of electricity consumption was interpreted as a confirmation of this persuasion: the exponentially growing curve of electricity consumption and production became an idealized mirror image of the European welfare state, with its endless frontiers and limitless growth, heading for an ever better and more beautiful world reaching out to everybody in society.

In the 'new' electricity system that started to slowly crystallize from the late 1980s onwards, the 'old' electricity system building culture has come to be viewed as something quite distant from the actual present situation. One could speak of the rise of a 'postmodern' system building culture. By 'postmodern' I mean a culture in which goals, development paths and meanings become fuzzy and unclear, where system governance is being decentralized and fragmented, where planning is not necessarily for the long-term, and where it possibly even becomes unclear what electricity actually is. These aspects should be discussed somewhat more in detail below.[29]

First of all, it may be repeated that in an increasing amount of countries, the electricity sector is no longer a growth business. Even if there in future will be room for some slight increases in electricity consumption, the general picture is undeniably one of an obvious trend shift, which in a number of countries started in the late 1980s. In the third industrial revolution there is no longer any serious room for electricity as a driving force in societal transformation, no room for linking it with any great visions for the future. Electricity has lost its progressive, transforming and modern aura. It has simply no longer anything important to say or to contribute in the creation of a 'better world'.

The above observation also means that the 'goal' of the electricity system is not anymore as clear as before. In the 'old' system most actors could more or less agree with each other about the system's primary goal: to provide both industry and households with cheap, ubiquitous electricity and thereby create new developmental opportunities for people and businesses. Every step on the road towards realizing that vision was a clear step *forward*. In today's electricity systems, in contrast, it has become utterly unclear what 'progress' actually means, since different actors interpret the electricity system in very different ways and thereby define the system's goal differently. It is above all the electricity companies themselves that in a radical way have re-interpreted the system's goal. 'Optimization of production' has in their interpretative frame been replaced by 'profit maximization'. Everything apart from that is secondary in importance. In addition, a number of new actors have entered the electricity system with a similar purpose, in particular banks, stock brokers, electricity trading companies and a variety of consultancy agencies.

[29] The rest of this section is based on chapter 8 in Högselius and Kaijser 2007

Furthermore, it can be seen that in those countries that have undergone deregulation, the previously highly *centralized regulation* of electricity systems has become much less pronounced. There still exist regulatory organizations with responsibility for the system's technical performance, but it is mostly a purely technical regulation, with the aim to keep the electricity system in technical balance on the short-term. In the past, 'regulation' had a much wider meaning. In contrast with the old, strictly regulated electricity systems the difference is striking. The earlier so important task to 'optimize production' have become irrelevant and anachronistic and it would today lead our thinking to illegal price and cartel cooperation. Instead, it is now the 'market' that decides which power plants should produce how much electricity, although this may often lead to technically 'irrational' use of the available resources. There is no central authority that can force an electricity producer to lower its prices or to enforce the start-up of some specific power plant for technically 'rational' reasons. The most interesting embodiment of this process of decentralization is the 'spot market', where relations between producers and users are totally anonymized, where there do not exist any 'optimal' electricity prices but where the invisible hand of the market decides how much electricity should be produced by whom and in what power plant.

'Efficiency' is now, as earlier, a central concept. But in the new, deregulated electricity systems we are not anymore talking about a technically efficient utilization of the system and its components, as was the case in the old systems. Instead, it is all about the competitive mechanisms of the market economy and the incentives these mechanisms create, through the threat of bankruptcy, firm-level economic efficiency, organizational rationalizations and synergies through mergers and acquisitions, etc. Technological innovations have stepped back for organizational, institutional and financial innovations. Technocratic, engineer-inspired viewpoints have been replaced by a complete belief in the market's ability to create efficiency – as codified in the new legislative acts in those countries that have undergone deregulation. The prime hero in this new electricity system is no longer the power plant engineer, the R&D manager or the product developer, but the stock broker, the chief lawyer and the corporate finance expert.

Similarly, planning horizons have been substantially shortened. On the deregulated market it is no longer possible to predict how much electricity, from what types of power plants and at what price will be demanded in the future. The result is that uncertainties have grown dramatically for electricity companies and others who would like to invest in large-scale power plant projects, new trans-national physical links, etc. Large-scale projects have in the deregulated system lost much of its previously so obvious advantages.

On a more fundamental level it has become somewhat unclear what electricity actually 'is'. In many actors' perspectives electricity is nowadays to be treated just like any other goods for trade, although it is being delivered through an unusually sophisticated system of distribution channels. Customers pay their electricity bills just like any other bills. At the same time, if electricity was earlier regarded as a driving force in societal development, it now rather stands for a 'necessary evil' which is being associated with environmental destruction and – in some groups' perspectives – capitalism's

unscrupulous abuse of innocent consumers. Electricity is being associated with social uncertainty and insecurity rather than with growth and wealth, as illustrated in recent years through a number of dramatic network breakdowns and dramatically varying electricity prices. The electricity system has thereby symbolically become something of an antithesis to the picture of the European welfare state.

At the same time, a number of economists, politicians and electricity company managers have a dream: to decouple the electricity business from its underlying technology. It is a dream of actors being able to behave in their everyday operations just like any other 'normal' sector in the economy, without being dependent upon any particular electricity-related technologies. Traditionally the electricity business suffered from always being noted for its very peculiar characteristics, which was always an argument for it not to become a 'normal' sector in society. But with the help of information technology and a number of sophisticated organizational and financial methods actors are now dreaming of an electricity system that in the future will not have any specificities that make it differ from other industries to any significant extent. It is a dream of being caught without restrictions into the maelstroms of capitalism, of the free market and an unfettered globalization.

It is this dream that has enforced a dramatic generation and cultural shift in the electricity sector. The technocratic engineering culture is on its way out, it is being replaced by a world dominated by professional managers, economists, lawyers and consultants that need no longer be experts on the secrets of the underlying technologies, but whose core competencies are totally directed towards achieving firm-level economic efficiency and profitable financial transactions. This has led to severe conflicts and oppositions within many organizations – a fact that even more serves to underpin the radical aspect of the transition to the new era. It is no coincidence that nearly all electricity companies have installed new CEOs and Chairmen in the recent period, many of whom have an interesting thing in common: they have not had anything to do with the electricity business prior to their appointment.

In summary, it can be concluded that the European electricity system at the turn of the millennium was characterized by a far-reaching lack of growth, utterly diffuse – or simply non-existent – system goals, an increasing absence of central governance and planning, competition rather than cooperation, a shift in focus from concrete technics and materiality to abstract finance and law, technocracy giving way for firm-level profitmaking, a lost belief in grand scale and a dream about a 'de-technified' electricity system – and a striking generation shift as a consequence of old actors' inabilities to deal with this new world of electricity. And above all: the electricity system had lost its once so proud role as a driving force in societal transformation, the system had lost its previously so central *meaning*. It had become a postmodern electricity system.

## 6. Summary and conclusion

This paper has discussed the trend shift in the European electricity industry from the 1980s up to today. The starting point was the simple observation that many European

countries have from the mid-1980s experienced a far-reaching stagnation in domestic electricity consumption. The study of periods of stagnation seem not to belong to the favourite areas of inquiry within the history of technology. However, simple observations regarding far-reaching institutional and organizational transformations in electricity during the 1990s seem to hint that there are interesting aspects to focus on even in stagnating systems. It was then suggested that in order to understand this stagnation and its consequences, the evolution of electricity systems in the end of the 20th century will have to be contextualized by seeing it as embedded into a number of important societal trend shifts that may be summarized under the label of the 'third industrial revolution'. We summarized this by concluding that a transformation pressure was built up from the 1970s onwards, a pressure that seemed to point in the direction of institutional adaptations and internationalization of electricity markets. This was also what followed in the 1990s.

Paradoxically, therefore, from the perspective of a number of large electricity companies, the new growth-less era has become a period of unprecedented expansion. This was made possible through the creation of totally new methods of system-building and transnational interlinking, based on 'financial engineering'. It is an almost totally non-technical style of transnational system-building, but there is no doubt about the fact that this process has resulted in a complex web closely inter-linked European electricity systems. The difference is that the system-building hero in this new electricity system is no longer the power plant engineer, the R&D manager or the product developer – instead, the postmodern system-builder is the stock broker, the chief lawyer and the corporate finance expert.

Among European organizations other than the electricity companies themselves, we observed that the EC Commission played an important role, while other transnational organizations such as Eurelectric rather put a brake on the development.

We proceeded by interpreting the transformation as a 'cultural shift' with a number of aspects that seem to justify the interpretation of electricity systems in the new era as 'postmodern' systems: they were characterized by a lack of growth, utterly diffuse – or simply non-existent – system goals, an increasing absence of central governance and planning, competition rather than cooperation, a shift in focus from concrete technics and materiality to abstract finance and law, technocracy giving way for firm-level profitmaking, a lost belief in grand scale and a dream about a 'de-technified' electricity system – and a striking generation shift as a consequence of old actors' inabilities to deal with this new world of electricity. And above all: the electricity system lost its once so proud role as a driving force in societal transformation, the system lost its previously so central *meaning*. It became a postmodern electricity system.

Of course, the emphasis in this chapter on non-technical aspects does not mean that there has been no processes of technical change within the European electricity systems. A number of new power plants have been built, while others have been shut down, and new technologies in terms of, for example, wind and solar power have experienced a rapid growth. At the same time, the EU has not only dealt with institutional issues, but in

parallel also launched more material projects – notably in the form of transnational electricity connections within the scope of the Trans-European Networks (TEN) programme. However, these developments have in effect been a quite marginal change if compared to the revolutionary transformations in the non-technical dimensions.