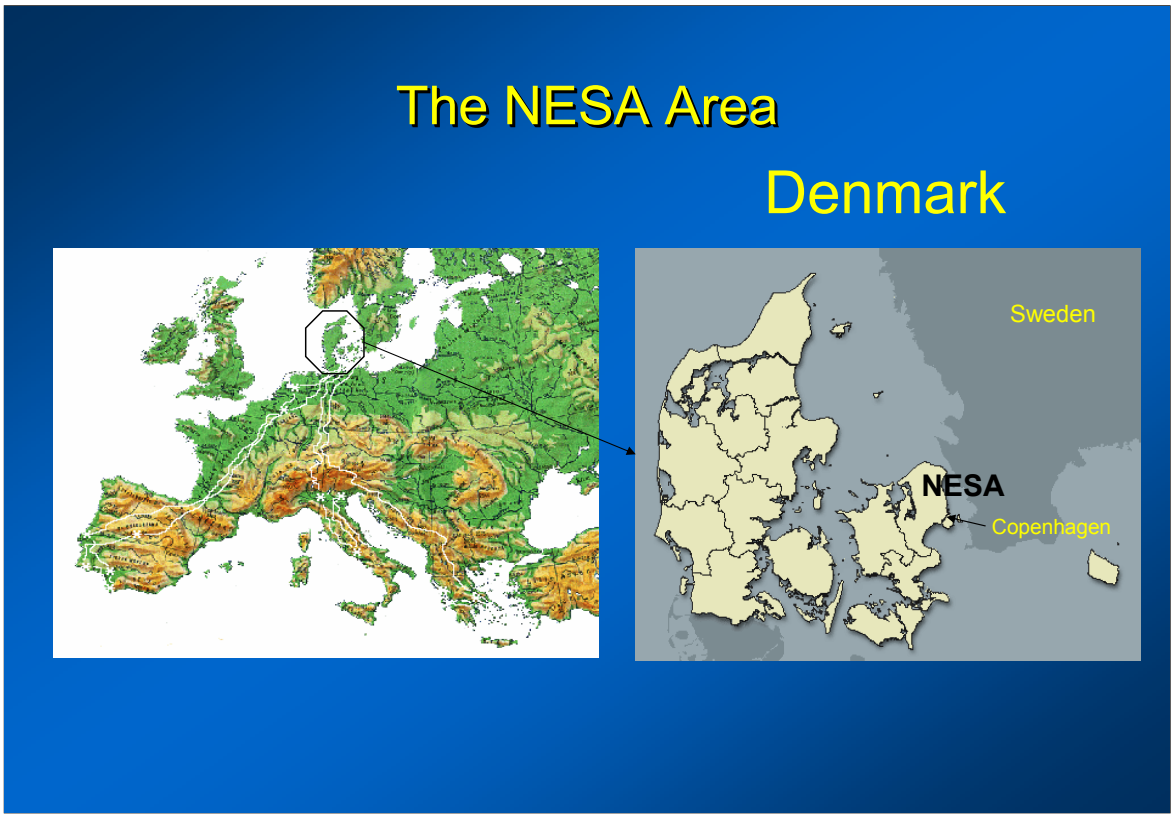
Ladies and gentlemen,

I could talk about any country, but I will use my own country because that is the one I know the best. So I will talk about the situation in Denmark, where we are today, and a little bit about how we have gone there.



Just to show you where we are in the world. Somebody of you might know it. This is Western Europe and Denmark is a small appendix here on the top of Germany. NESA is the company which supplies energy to the area around metropolitan Copenhagen. It is the largest electric utility in Denmark. We have about half a million customers. It is our job to secure the transmission lines as well as the transmission to the metropolitan of Copenhagen.

Km of network owned or serviced by NESA

	0.4 kV	10 kV	50 kV	132 kV	400 kV
Cable Oil filled	450	3540	165	25	0
Cable XLPE	5251	1537	101	75	34
OHL	3618	0	166	316	317
System	9319	5077	432	416	351
Ratio Cable/OHL	61 %	100 %	62 %	24 %	10 %

The size of our network is not big, but you can see, we have around 17,000 km of lines, mostly on 400 V, which is near the customer. But we also have a tremendous amount of medium voltage and even some transmission lines. We have about 400 km of 50 kV and 132 kV. We also have 350 km of extra high voltage lines (400 kV). It is not all owned by NESA but we maintain and operate it for the owner, which is the national grid company.

NESA policy of cable laying

	0.4 kV	10 kV	50 kV	132 kV
Part of system under ground	61 %	100 %	62 %	24 %
Building of new OHL ?	NO	NO	NO	Hardly
Last laying of Oilfilled cable	< 1970	< 1980	1976	1988
System totally under ground	2015	2003	2025	????

NESA is replacing OHL with cables whenever it is the technical and economical optimal solution

Asset Management and LCC tools

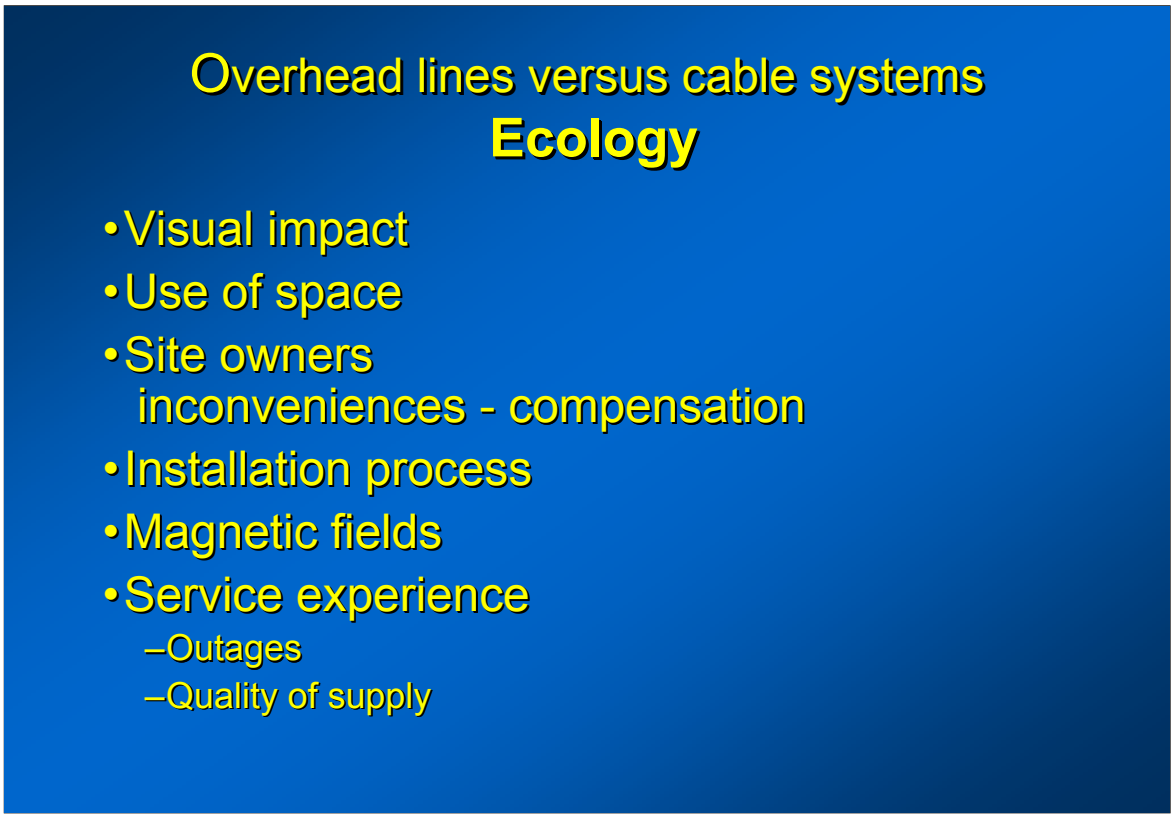
Where are we today in NESA? As you can see from the point of view of cables versus overhead lines, on the 10 kV network we have now today, and I mean today, a system totally underground. Right now at home they have a celebration because they have dismantled the last overhead line.

On 400 V we have 61% underground and we are planning to have all 400 V cables underground in 10 years. 2 years ago we had a big storm which took out a lot of our overhead lines on 400 V. Some customers were out of energy for up to 4 days. We cannot tolerate that. Therefore our board made a decision to replace all 400 V overhead lines during the next 10 years. It is an investment of $300 million, which is quite substantial for our company.

Also on 50 kV we have a lot of cables (62% and growing) underground. When an overhead line is worn out, we will exchange it for a cable.

Even on 132 kV we have 24% of cable underground. We do not yet know when the rest will be underground. There are no actual plans.

If we build a new line for 400 V, 10 kV, 50 kV it will certainly not be an overhead line, for 132 kV it will hardly be an overhead line. Today our policy is to replace overhead lines with cables, whenever it is technically and economically the best solution. In order to do that, we use asset management and life cycle cost (LCC) analysis.



So far I have shown you where we are today. Now I will show you why we are there, because that could be important for you. The ecology and also the economy and the politics have to be considered.

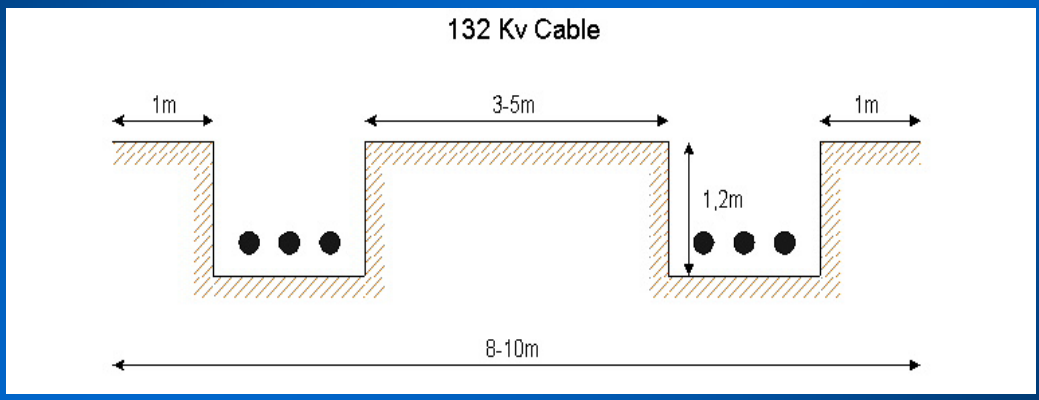
The visual impact is a very important aspect. People in my country, just as in many other countries, don't like overhead lines. They are not pleasant, they are not nice to look at, they are disturbing due to their noise. Many people also think that they lower the price of their houses. So, there is a lot of pressure to bring overhead lines down and certainly not to build any new ones.

Our country is not the highest in the world. The highest point in Denmark is 179 m. Overhead lines will be very visible. We have a lot of nice nature reserve areas, again an overhead line there would be totally improper.

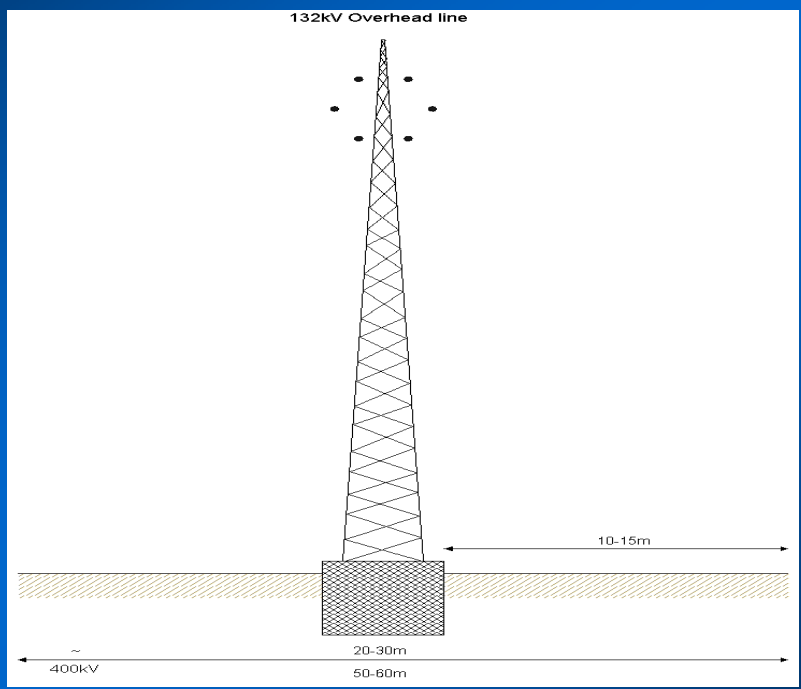
The second point is the use of space. If we want to substitute an overhead line in Denmark, the normal thing to do is, due to the transmission capacity, use 2 cable systems. I will come back to this, because this might not be correct in all cases. But if you do that, you need for a 132 kV 2 systems and it is the same for 400 kV. You need 8 to 10 m in case of a 132 kV cable system.

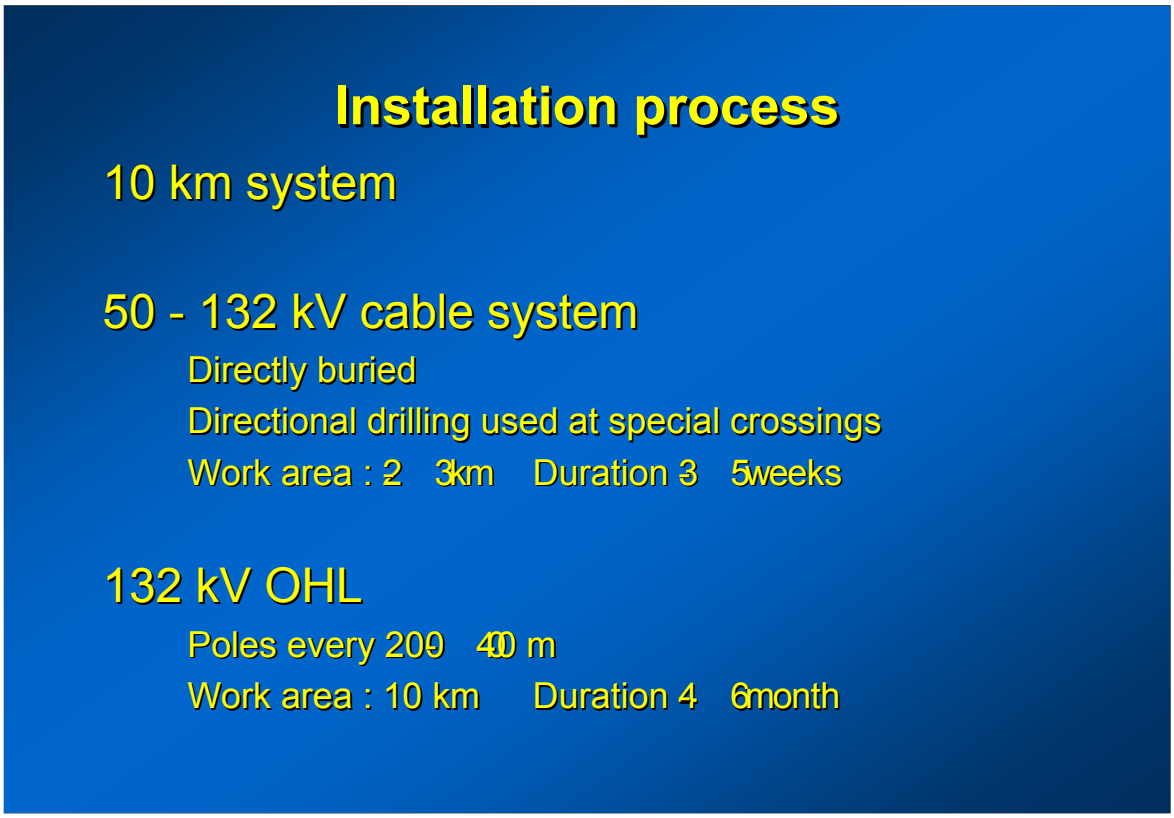
If you go to overhead lines you need 20 to 30 m on 132 kV and you need up to 60 m on 400 kV. That is a tremendous loss of space. If you build a cable system, you can place it conveniently along roads. So it does not take away any nature area.

Use of space



Use of space





Another point of view is the installation process. If we lay a cable or an overhead line in urban and rural areas we make disturbances. It is not decisive, but it still is a concern for the local community where we build that new line. If we want to build a 10 km long cable system, in Denmark we do it almost always directly buried. If we have some special crossings, like railroads, big highways, we use directional drilling. But most frequently we use directly buried cables because of the cost. It is the most inexpensive way to do things. The duration for the work is about 3 to 5 weeks with a work area of 2 to 3 km. On an overhead line we have to build poles and the working area is 10 km with a duration of work for a very long time, usually 4 to 6 months. This disturbs the traffic and the public. In this sense, cables are the better solution.

Compensation to site owner

Compensation is given for

- –Restrictions on area of declaration
- –Damage on crop

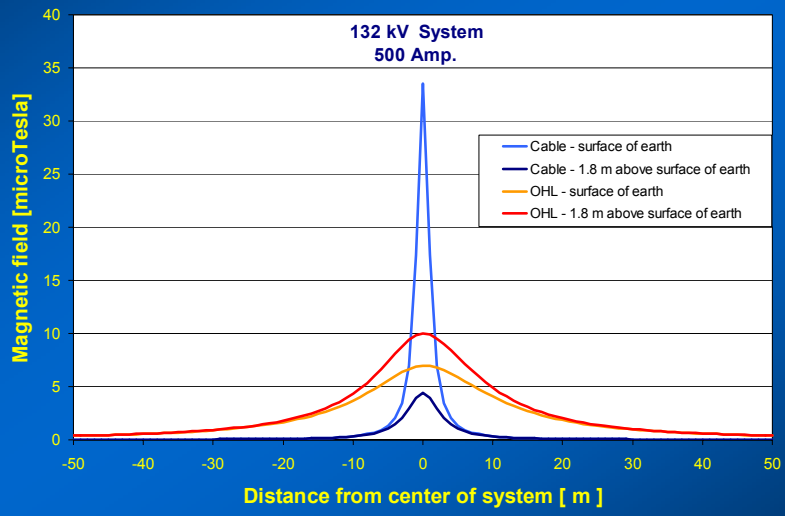
New 132 kV overhead lines :

Offer to buy houses nearer to system center than 35 m

(At 400 kV : 50 m)

We can normally put a cable in a road. But sometimes we have to be in the land owned by somebody. In these cases we have to pay compensations, because there are some restrictions on the land. You cannot build a house on a cable or plant trees on cables, the same holds for overhead lines, but the area we use with cables is far much smaller. We also have to pay for the damage of crops. This is the case for cables and overhead lines. One thing is not the same. In Denmark, if we want to build an 132 kV overhead line and we get nearer than 35 m from a house, then we have to offer to the owner of the house to buy it. That is a tremendous cost that is additionally put on the installation cost of an overhead line. If it is a 400 kV overhead line, it is 50 m. Therefore, the use of space and the compensation is quite in favor of cables.

Magnetic field



The magnetic field is a very important issue. In Denmark we have made studies for 30 years on the correlation between the magnetic field, the electric field and cancer. These studies were made by independent researchers, some were sponsored by the government and some by the electric utilities. The results show that today there is no correlation between cancer and overhead lines.

When we compare the magnetic field of cables and overhead lines , the level of the magnetic field is much higher for the cable system at the surface of the earth and a distance from the system of less than 2 m. But at a height of 1.8 m (average length of a human being), overhead lines show a higher magnetic field. If we go away from the systems, the magnetic fields of cables drop very rapidly. After 10 m the field is negligible for cables, for overhead lines this is only after 50 m the case.

Magnetic field

The Danish ministry of health concludes at the moment

- –Setting minimum distance to HV lines is not needed
- –Setting of limit value for magnetic fields from HV lines is not needed

The following principle of caution is used:

- –It is aimed not to place HV lines near existing residential area
- –New areas of residence shall not be placed near existing HV lines

It is the local authorities (Municipalities) who are managing these principles of caution

Based on these findings, our government had made a decision that it is not necessary to set any minimum distance to high voltage lines or any limiting value for magnetic fields. Instead of this, they say, that you have to be careful not to place high voltage lines near existing residential areas and vice versa. These principles are managed by the local authorities. We have to work together with them, when we define the exact position of the line.

Quality of Supply

Causes for outages

Equipment	% of interrupt.	% of duration
10 kV Cables	28	21
10 kV OHL	30	43
10 kV other equipm.	14	20
50-400 kV	28	16

Average per 10 kV transformer*year :
Interrupt. : 0.64 Duration 45 min

Failure Frequencies

	50 kV		132 kV	
	ex. reclose	Total	ex. reclose	Total
Cables	0.31	0.38	0.46	0.46
OHL	0.54	2.31	0.43	2.72

You heard about the blackouts recently. We had one in Scandinavia last month. It had nothing to do with lines. There is quite a bit of pressure to guarantee a very good supply of electricity, because electricity is an important issue and it costs a lot of money. In Denmark we have no penalties. But I know in many countries they have penalties for not supplying energy. That is also an issue to take into consideration.

Where do the interruptions come from? Looking at the Danish fault statistics covering a 10 year period 1993-2002 you can see, that it is the 10 kV network. It has 72% of all interruptions and the cable and overhead lines are the main cause.

We look very closely at our fault statistics. For 50 kV and 132 kV I tried to compare cables and overhead lines without reclosure (automatic reconnection after failure) and with reclosure. The total amount shows for overhead lines a far larger value (almost 6 times) than for cables. Although the fault is cleared by reclosure, it can cause disturbances for some customers.

Many of the failures of our cables are occurring in the old oil-filled cables. The new XLPE cables show a much better performance.

So, from an ecological viewpoint an underground cable system is the best solution.

Overhead lines versus cable systems
Economy

- Transmission capacity
- Costs
  - Construction
  - Maintenance / repair
  - Losses

There is another very important driver in the electric utility today, that is the economy.

Transmission capacity, Overload

Load before incident : 50 %

Permissible overload and duration

	1 hour	5 hours	10 hours
Cable	300 %	220 %	190 %
OHL	130 %	100 %	100 %

Earlier I told you, that you should use 2 cable systems, when you exchange an overhead line. That is normally correct. The systems, in particular high voltage and extra high voltage lines, are built in a redundant way. Not all lines are busy up to a 100%. They are actually used with a capacity of less than 50%. The spare capacity can be taken into consideration. So when you compare cables with overhead lines, for one hour the cables can be overloaded 3 times and for 10 hours it can still be 190%, nearly twice. In contrast to that, overhead lines can only be overloaded for a short time. Most of our troubles are cleared in 10 hours.

If you take this into consideration, in many cases you just need one instead of 2 cables, when you exchange the overhead line.

Cost ratio, Building new lines

Voltage level	Cost ratio Cable / Overhead line
0.4 – 10 kV	< 1.0
50 kV	~1.0
132 kV	1.5 – 4.0
400 kV	4.0 –10.0

The cost ratio is very important. In Denmark, for low voltage and even 10 kV, cables are cheaper than overhead lines, when looking at the cost of installation. On 50 kV it is more or less the same today.

For 132 kV the cost ratio is 1.5 to 4.0. If you need only 1 cable system, then it is 1.5 to 2.0, only if you need 2 systems it becomes 4.0. Even on the 400 kV we can get it down to a figure of 4.0, if we only need 1 system.

So it is very important to plan our system and use our money correctly.

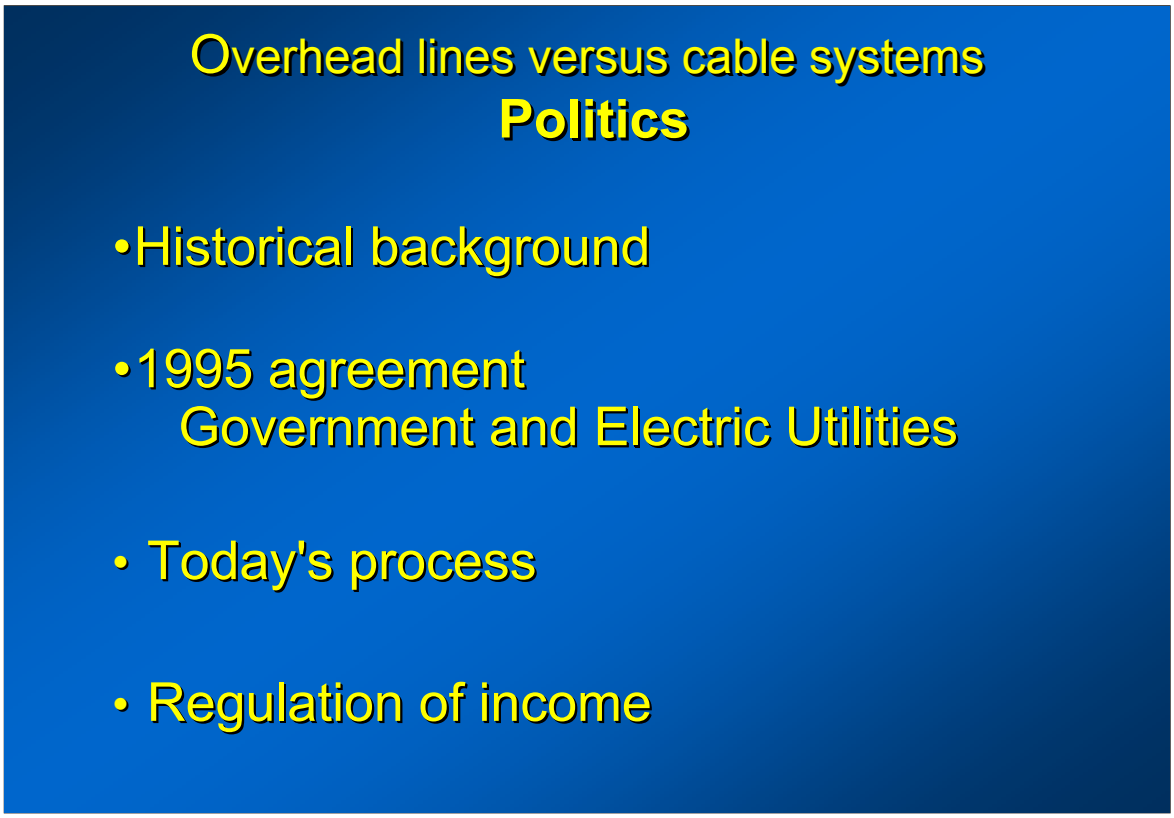
Our policy of not using overhead lines is closely related to the price of the cables and overhead lines and the cost of installation.

Other costs

	Overhe-ad lines	Oil filled cables	XLPE Cables
Maintenance	High	High	Low
Repair	Low	Very High	High
Losses	High	Low	Low

Of course there are other costs, like the maintenance cost, the repair cost and the losses. But these figures are not used so closely. We know the maintenance cost quite well. But we only use the others, when the gap between cables and overhead lines is rather small.

We want to do the economically best solution and therefore the price of our cables should be as low as possible.



So far we have talked about the ecology and economy. Those are usually the basis for political decisions in the government, in our company and elsewhere.

The discussions on cables versus overhead lines started around 1990. There was a plan to build a new 400 kV DC line from Denmark to Germany. The first 100 km over land were planned as an overhead line and the last 25 km on the ground, as it was not suitable for overhead. This was the plan. When it became public, people said: It cannot be true, to build an overhead line over my backyard. In addition there was a comparison of the cost of cable versus overhead line. They found out that the DC line would be 1.5 to 2.0 times more expensive for a cable than it was for an overhead line. So our Ministry decided to build a cable. We used 4 years for this decision process. We wouldn’t do it again.

Therefore the government and the electric utilities established an agreement in 1995.

1995 agreement

Government and electric utilities

Principle for Establishment and Reconstruction of High Voltage Lines

Participants

- Ministry of Energy
- Ministry of Nature and Environment
- Counties
- Electric utilities

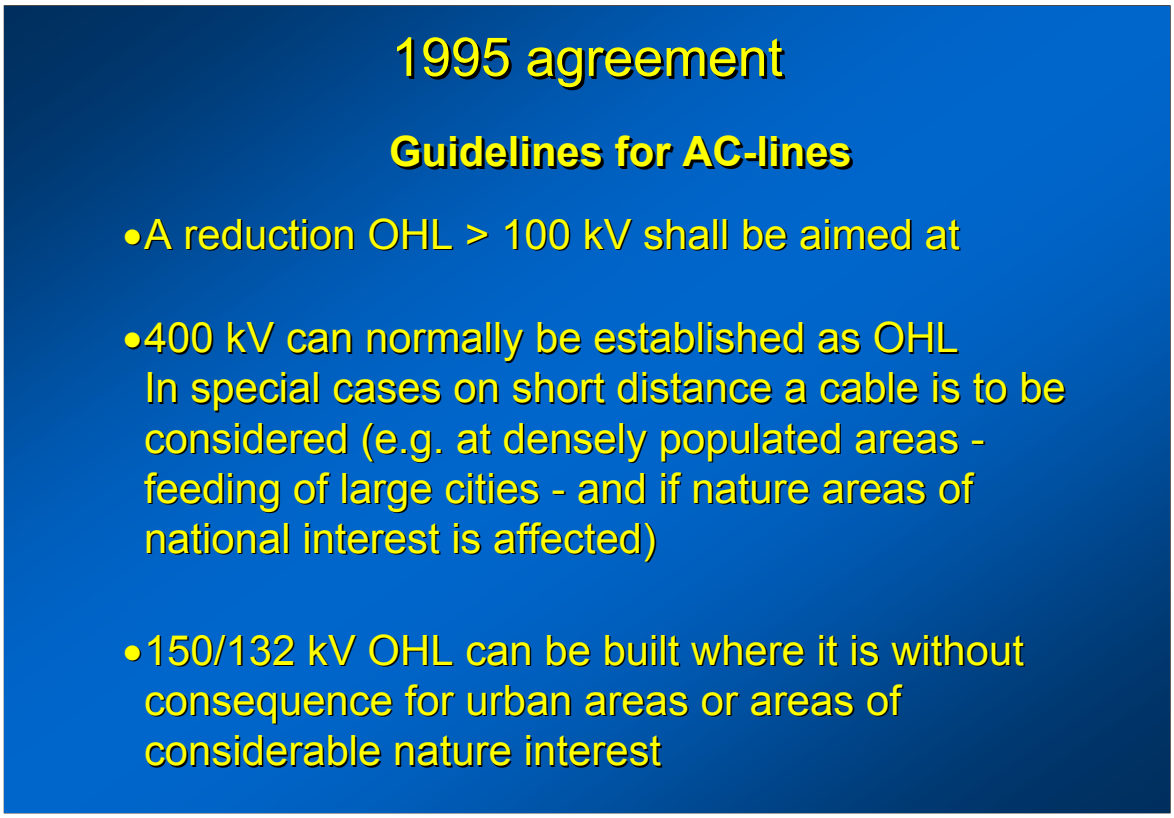
This agreement is both covering new lines and the reconstruction of existing lines. The participants were

the Ministry of Energy, responsible for our systems,

the Ministry of Nature and Environment, responsible for the environmental issues,

the counties, representing the local people,

and the electric utilities.



Based on these talks we got some rules which we use today. I will talk about the highlights of these rules.

The overall aim is to reduce the amount of overhead lines larger than 100 kV.

Even on 400 kV we cannot be sure to have overhead lines. For example, in the other part of Denmark they are building a 100 km long 400 kV line. It was supposed to be an overhead line. But there were a lot of problems and they decided to use 95 km of overhead lines and to use cables for the last 5 km. They go into a big city and cross 2 nature areas.

We have the possibility of building overhead lines for 150/132 kV. Because of the approval time and the other issues, I think, nobody will do it.

1995 agreement

Guidelines for AC-lines

- At reduction of 132/150 kV OHL. It is aimed to replace lines placed inconveniently in relation to built up areas or substantial nature interest
- New lines <100 kV are established as cables
- Existing 50 60 kV OHL are established as cables if the lines are disadvantageous in relation to built up areas or substantial nature interest.
- In connection with major reconstruction works existing lines are considered equally with new lines

In connection with reconstruction works existing lines are to be considered just like new lines. This means, that the government says: You shall use cables in most cases up to 132 kV.

In NESA we have no plans to use overhead lines.

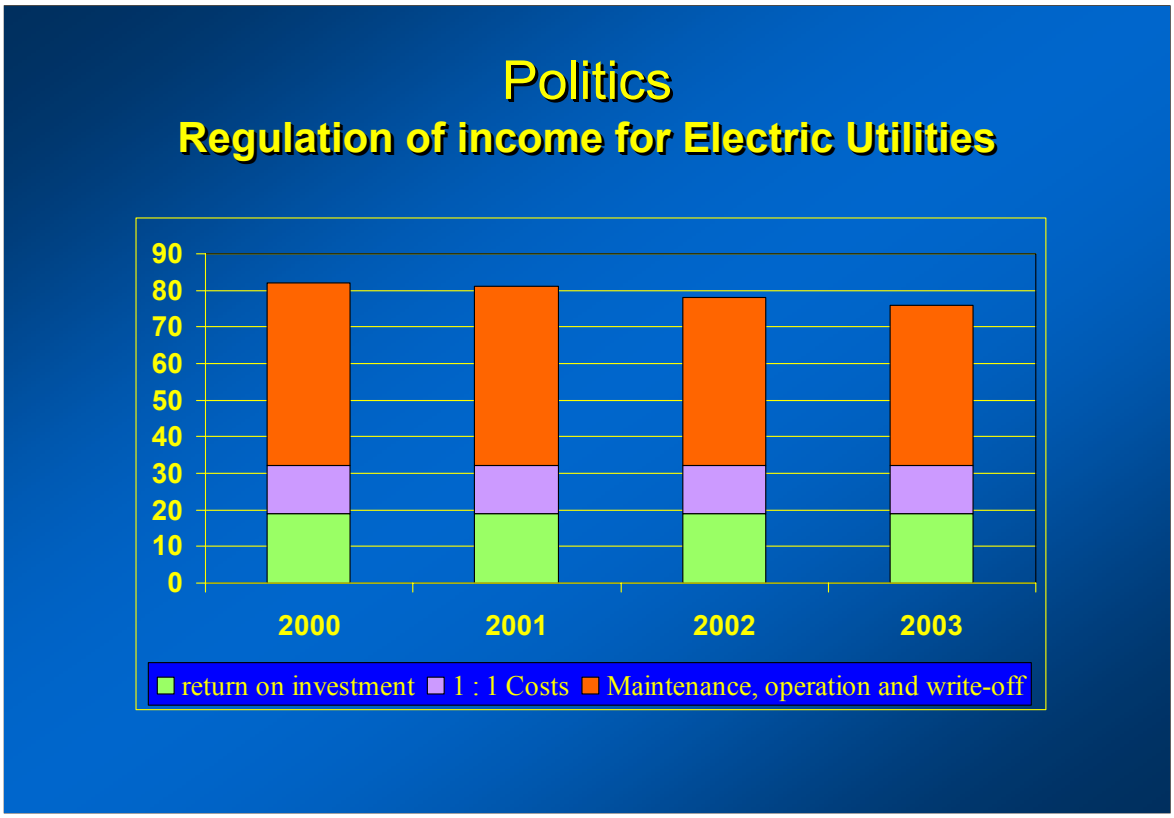
1995 agreement

Guidelines for DC-lines

- Cables are used regardless of voltage level at new lines and major reconstruction of a line

If you take DC, of course, everything should be cables.

That is were we are today.



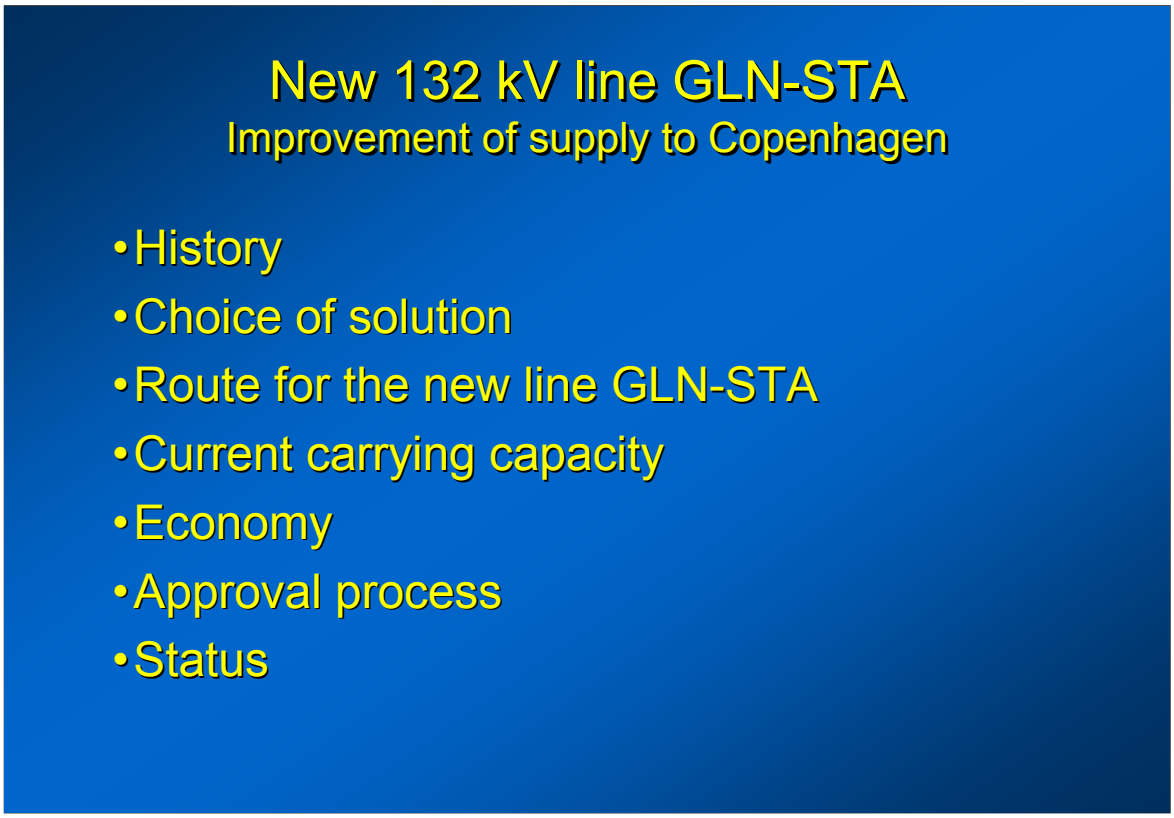
How do we get our money? This is a big question for utilities, because you have deregulation. In Denmark we as a transmission company, get our money as a fee for the energy that we transport. This fee we get once a year. It is based on 3 things.

We have invested in the network and should have something back for our investment. These figures are relative. The percentage of our investment, that we should get back, is determined by the government.

We also have some costs, which I call 1:1 costs. These are costs we accumulate in a year and then get back from the government. We have to do some energy saving programs or some investigations. For all of this work we get the money back from the government. There is one important issue with overhead lines and cables. The money, we use for dismantling overhead lines, it belongs to this kind of cost, too. If we use $10 million to take down an overhead line, we get back the $10 million the same year. This helps us to put cables in the ground.

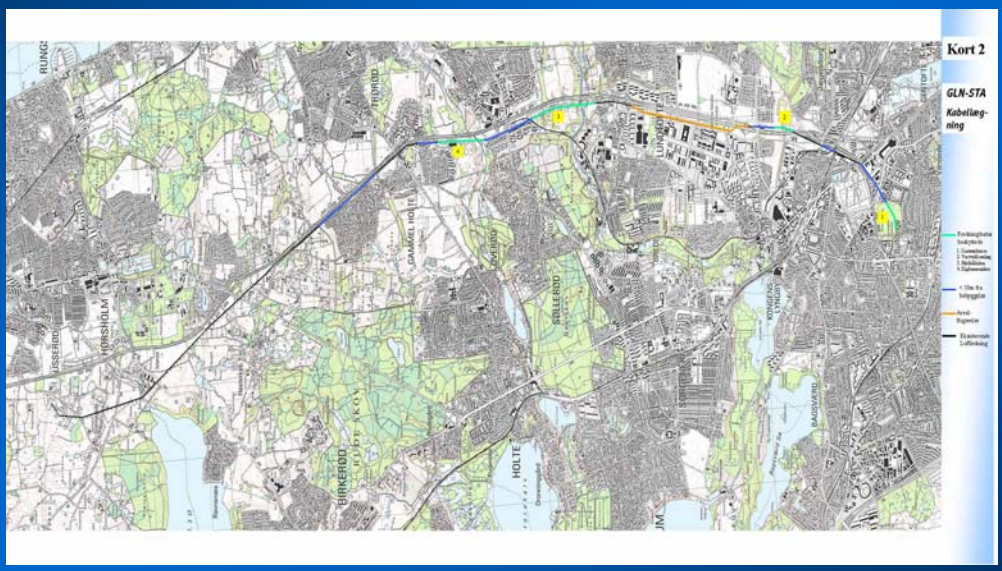
The largest part of our spending belongs to maintenance, operation and write-offs. When we invest in a new line, we get the money back over 40 years.

As in every other country the government wants us to become cheaper. They put pressure on us, by telling us, that we should reduce our costs every year by 3%, or in case you are a bad performer, it can go up to 13% per annum.



In order to show you the situation today, I have an example, which is from my own company. We are building a new line, to secure the energy transfer to the Copenhagen area. We have to be independent of the power generation. Therefore, we made an investigation together with the company which is responsible for the system. Over one year we looked at all the different solutions for the best line to Copenhagen.

New 132 kV line GLN-STA



We found out that this line between these 2 substations was the most convenient one. Now we know where these lines had to be built. Maybe it is a little bit hard to see. These are actually existing overhead lines, which are ready for dismantling. This was the best place to put a new line. The green areas indicate nature areas. The blue areas are densely populated areas.

The system people told us that we will use 325 MVA continuously, which meant 2 cable systems. After some discussions they told us that they really need 225 MVA continuously and 325 MVA for 6 hours from 50% load, which meant 1 cable system.

We only built one cable system. Comparing the cost for the cable system with the estimated cost for an overhead line system, the cable system is a factor of 2 higher.

Approval process & Status

Jan - Sept. 2002	Investigation of alternatives
Oct. 2002	Application to ministry of Energy
Oct - today	Approval process ongoing
??? 2004	Approval
2005 or 2006	Operation

Status : Process is ongoing - expected approval 2004
Delay of project 1 - 2 year

We made the investigation between January and September 2002. In October of last year we applied for approval. This process is still ongoing, because the people, living next to the installation route, are furious. They try everything to get the installation underground. We would happily do it, because they are our customers. But the Ministry of Energy is not allowing us to use more money. Now we are delayed for 1 to 2 years. We hope the system will be in operation in 2006.

I hope that we can take down this overhead line. Some of the poles are standing in the private garden of people, 10 m away from their houses.

That is, where we are in Denmark today.

Thank you for your attention.