



ANNUAL REVIEW 2022

VEKS

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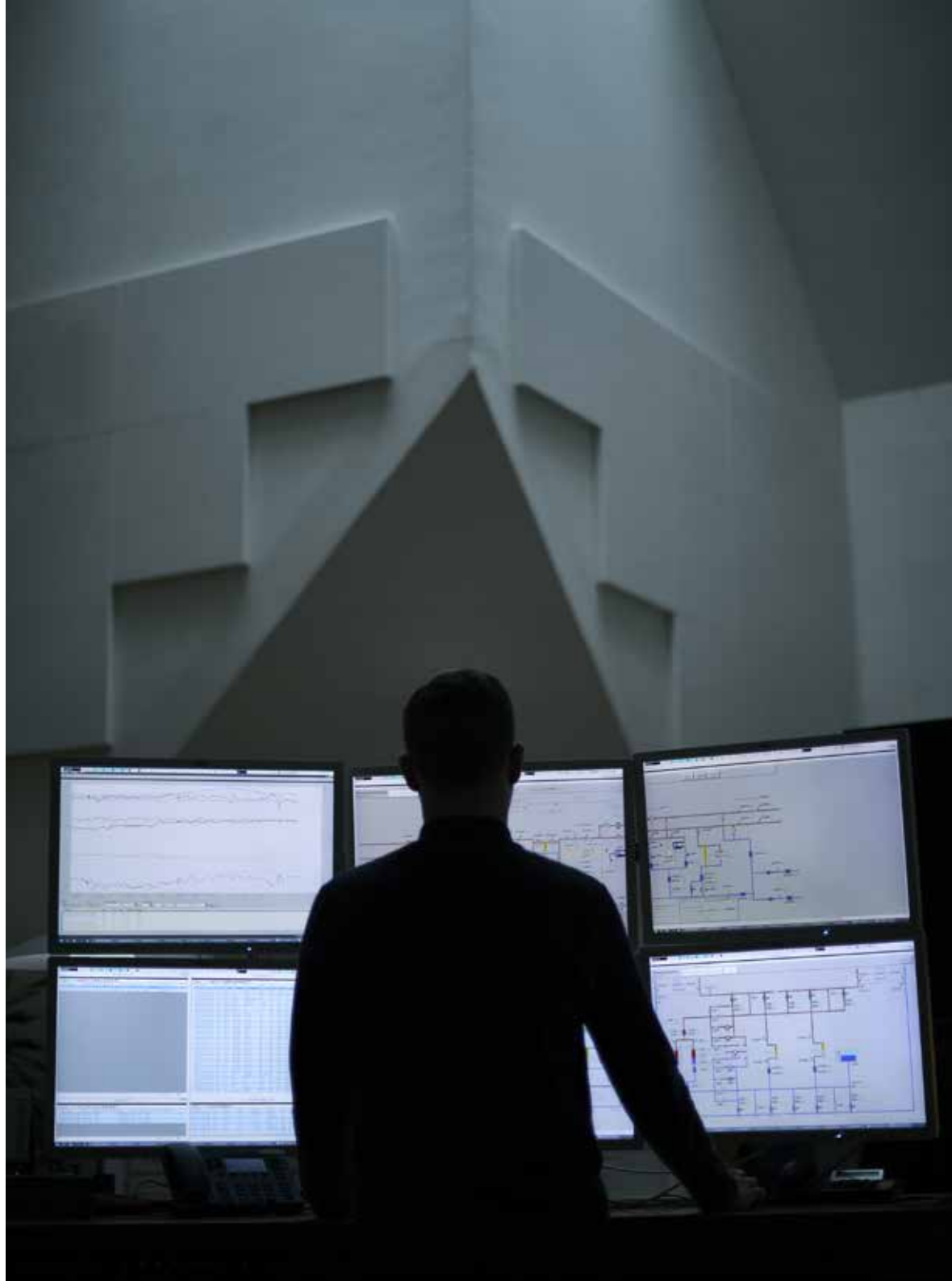
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The set of pictures of the year has preparedness as a superior theme. The shootings from the operation centre, the peak load units, the new heat pit storages, etc. show the versatility of the different tasks which VEKS' employees handle to ensure the district heating supply.

PHOTO: Claus Peuckert Photography

Bumps on the road prevent more green district heating

We find ourselves in a historically crucial time: How will our energy system develop over the next decades – long into the 2050s? The decisions we make in these years relating to roll-out of district heating, heat production technologies, heat pit storages, wind, sun, hydrogen, carbon capture, etc. will define how the future intelligent and flexible energy system is going to be developed to support the green transition. We are well under way finding new solutions and have just put the large heat pit storage in Høje Taastrup into operation. This storage improves the flexibility of the system and connects the power and heating sector more efficiently.



Emphasis is also on conversion! In Køge and Tranegilde District Heating alone, up to 8,000 households are going to be converted. In the whole VEKS supply area, approximately 30,000 households will be converted from fossil gas to green district heating over the next 5-6 years. It is a considerable part of the total conversion potential for the whole country: "The heating plan Denmark 2021" recommends that up to 260,000 buildings are converted.

The conversion from gas to district heating plays a decisive role in order for Denmark to reach the CO₂ goal of a 70% reduction in 2030.

There is strong support from both municipalities and district heating companies in VEKS' supply area when it comes to setting up the green transition – fast and efficiently. In Customer Forum and the Board, we cooperate across the municipal borders on finding solutions to get district heating out to everybody, where it makes sense.

It is a huge task. The government has given a deadline till 2028, however, there are some bumps on the road which need to be levelled before we can reach our ambitions.

On a national level, we can see a drastic increase in the demand for district heating projects and we see the same in VEKS' supply area. The employment challenges have increased significantly in relation to the extensive conversions to district heating.

More specifically, the pricetag on bids on projects have increased significantly during the last 5-6 months. It challenges projects-economy and thus the green transition. We see that practically all VEKS' customers – the local district heating companies – have the same challenges.

- Pipe prices have increased as a result of the high steel prices.
- Welding is now more expensive.
- Excavation cost has increased by 100% in the past year.
- It is difficult to find soil handling places which means that the soil must be transported a long way resulting in increased transportation costs.
- Purchase of materials such as gravel has increased markedly.

Add to this the fact that contracting firms are experiencing extraordinarily strong demands for their services which only forces the prices to rise further.

The government's national energy crisis staff – NEKST – is founded for the purpose of supporting a fast roll-out of district heating. It requires that the staff gains momentum and clears some hurdles on the way.

Translated into specific action, it could be:

- To have the announcement of a longer amortisation period worked out fast.
- To have the national district heating support scheme filled up and put to work.
- To allow for the earth handling to be more flexible (transport across municipal borders, etc.).
- Preprioritisation of public construction projects to provide more workers.

Last, but not least, the new government could consider adjusting 2028 as a goal and to allow us more room for us to be able to plan and carry out the large conversion jobs.

The government must help straighten out the bumps in the road in connection with the district heating conversion. In the Danish district heating sector, we are ready to contribute significantly to the green transition.

Steen Christiansen

Chairman, VEKS

More specifically, the pricetag on bids on projects have increased significantly during the last 5-6 months. It challenges projects-economy and thus the green transition. We see that practically all VEKS' customers – the local district heating companies – have the same challenges.

Steen Christiansen

MANAGEMENT REVIEW 2022

The employees of VEKS' operation centre represent the core of VEKS' preparedness. The Operations Engineer on duty will always be the first receiver, e.g. of an alarm from the system. From the operation centre they also start the local peak and reserve load boilers which is the preparedness on particularly cold days or in situations of breakdown. Here, you see Operations Engineer Jonathan Egebøl and Operations Engineer Peder Ekelin (to the right) – the latter is the operations manager on duty on this particular day.

Object and main activity



VEKS, CTR and Høfor have agreed on a "Common preparedness plan for the distribution of heat upon global lack of fuel" from a solidarity principle. Operations Engineer Jonathan Egebøl discusses the system with Team Leader Benjamin Adamsen and Operations Engineer Peder Ekelin.

VEKS, Vestegnens Kraftvarmeselskab I/S, is an inter municipal general partnership which is operated as a non-profit enterprise. VEKS includes production, transmission and distribution of district heating in Vestegnen (Western Copenhagen) in the capital area. 12 municipalities with a total of 500,000 inhabitants are jointly and severally liable to VEKS' economy. The 12 municipalities are: Albertslund, Brøndby, Glostrup, Greve, Hvidovre, Høje-Taastrup, Ishøj, Køge, Roskilde, Rødovre, Solrød and Vallensbæk. VEKS was founded in 1984 and the primary objective of the company is to utilize heat from the CHP plants and surplus heat from waste-to-energy plants, major industrial enterprises, etc.

Mission: VEKS delivers secure, efficient and environmentally sound district heating

Vision: VEKS will speed up the green transition and deliver efficient and sustainable energy solutions through partnerships to the benefit of our customers.

VEKS' Strategy 2025 defines the business strategy and a number of focus areas – please find summary on page 11.

VEKS' district heating system

A total of 135 km twin pipes have been laid with 62 heat exchange stations and 18 pumping stations transmitting heat to the local district heating systems. Most of the heat is supplied to VEKS from Avedøre CHP plant and the other CHP plants in Copenhagen and from the waste-to-energy facilities ARGO and Vestforbrænding. The transmission system is controlled, adjusted and monitored from a 24-hour manned operations centre located in VEKS' headquarters in Albertslund. The supply reliability is high in the transmission company's area, as 26 local boiler stations can be used as reserves and for peak load during periods which are particularly cold.

Economy and organisation

VEKS consists of five separate areas within the same legal entity:
The name VEKS covers the consolidated activity within the given areas which are fully separated financially under the same CVR number.

Transmission

VEKS Transmission supplies 19 local district heating companies with heat in Vestegnen. The local district heating companies manage the redistribution to private customers, business customers and institutions. The heat supplied is equal to the consumption of 170,000 families.

Together with CTR and HOFOR, VEKS participates – each with an owner's share of 1/3 – in Hovedstadens Geotermiske Samarbejde (the Geothermal Cooperation of Greater Copenhagen) which operates a geothermal test plant in Amager.



Operations Engineer Jonathan Egebøl manages the operation and thus has the function of Single Point of Contact" in terms of VEKS' preparedness.

Production

Køge CHP Plant produces electricity for the grid, steam for Junckers Industrier A/S and sells (internally) district heating to VEKS Transmission.

VEKS Gasmotor in Solrød was established in December 2015 and produces electricity for the grid and district heating for VEKS Transmission based on biogas delivered from Solrød Biogas A/S.

Distribution

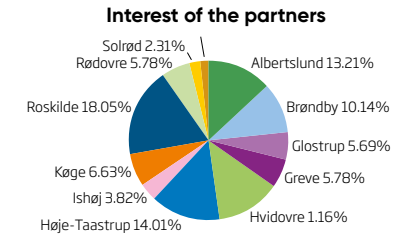
Køge District Heating handles the distribution of district heating to private customers, business customers and institutions in Køge. The heat is purchased internally from VEKS Transmission.

Tranegilde District Heating handles the distribution of district heating to customers in Tranegilde's industrial area in Ishøj and Greve. The heat is purchased internally from VEKS Transmission.

Legislation

VEKS is governed by S60 of the Danish Act on Local Government (Lov om kommunernes styrelse). For instance, this means stricter terms for taking up loans, etc. than those applicable to both consumers and sole municipally owned heat supply companies. As a collaborative heat supply company, VEKS must observe the regulations provided in the Danish Heat Supply Act when carrying out its business, including pricing.

For instance, this means that VEKS is subject to a financial non-profit principle which implies that VEKS in its pricing of heat must allow for income and expenses of the partnership to balance over a number of years.

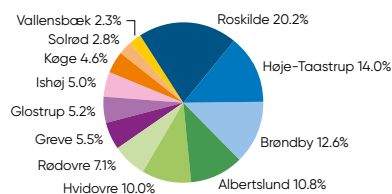


Key figures

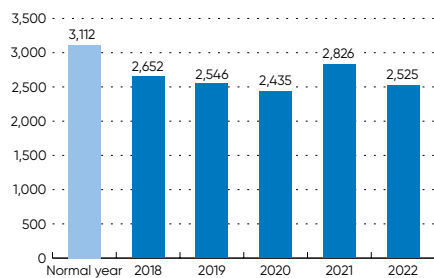
The company's development over the past five years can be described as follows:

(DKK million)	2022	2021	2020	2019	2018
Net turnover	1,380	1,343	1,227	1,345	1,283
Operating profit or loss	-73	-9	-21	30	-14
Financial income and expenses, net	-19	-18	4	-19	-28
Net profit or loss for the year	-56	86	14	23	-34
Equity, end of year	82	184	103	79	133
Assets, total	2,375	2,298	2,329	2,333	2,236
Fixed assets	1,838	1,832	1,897	1,854	1,858
Number of employees, as at 31.12	98	88	86	82	77
Net finance costs compared to fixed assets in %	1.1	1.0	1.0	1.1	1.6

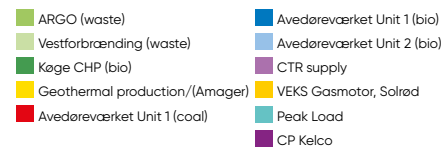
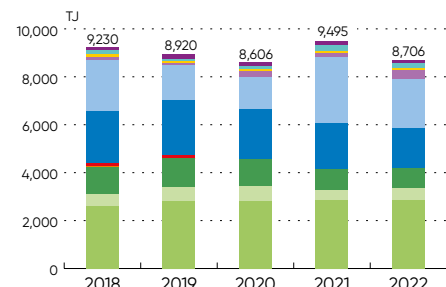
Purchase of heat in the municipalities



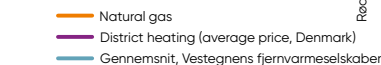
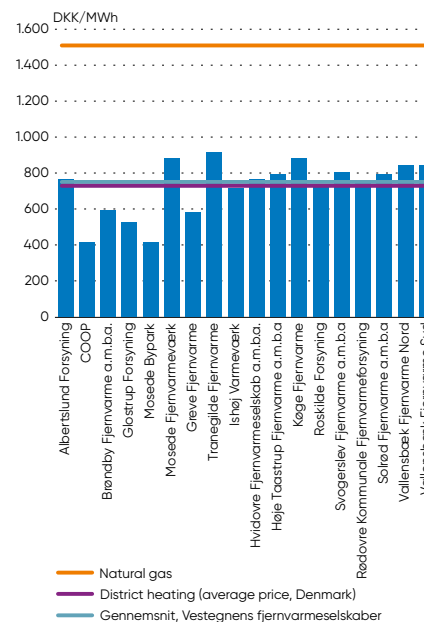
Degree days



Development in heat production (TJ)



Heating prices with the customer

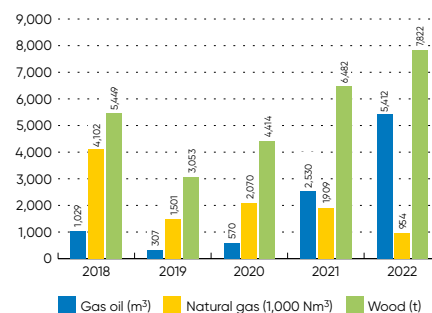


Heating prices paid by the district heating customers in Vestegnen

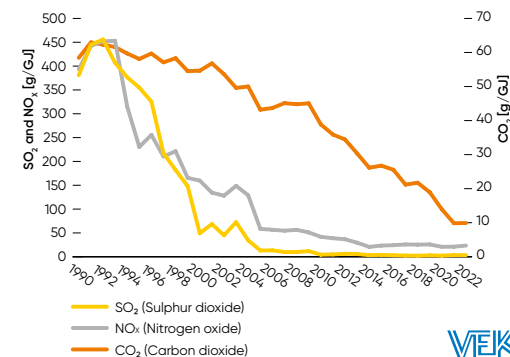
Pre-requisites:

- Prices according to the price statistics of the Danish Energy Regulatory Authority reported by the local district heating companies, December 2022. If the prices were not reported, the public prices are used – stated in the district heating companies respective websites.
- The average heating price is based on calculations made by the Danish District Heating Association for a "standard home" of 130 m² with an annual consumption of 18.1 MWh.
- There is no guarantee that all companies supply the type of "standard home" mentioned.
- The price is exclusive of connection fees.
- The supply point between district heating company and customer may vary from company to company.
- The price of heating with natural gas is provided by the Danish District Heating Association.
- The prices are inclusive of VAT.

Fuel consumption, peak and reserve load



Environmental declaration



Expectations for 2023

Heat supply agreements

In cooperation with the district heating companies to which we deliver heat, VEKS has initiated the next negotiation process which will result in new heat supply agreements. This time, the perspective of the agreements will reach further into the future and ensure that we will get a solid basis for contract for the future district heating with the new technologies which we are going to employ.

CO₂ capture – supply

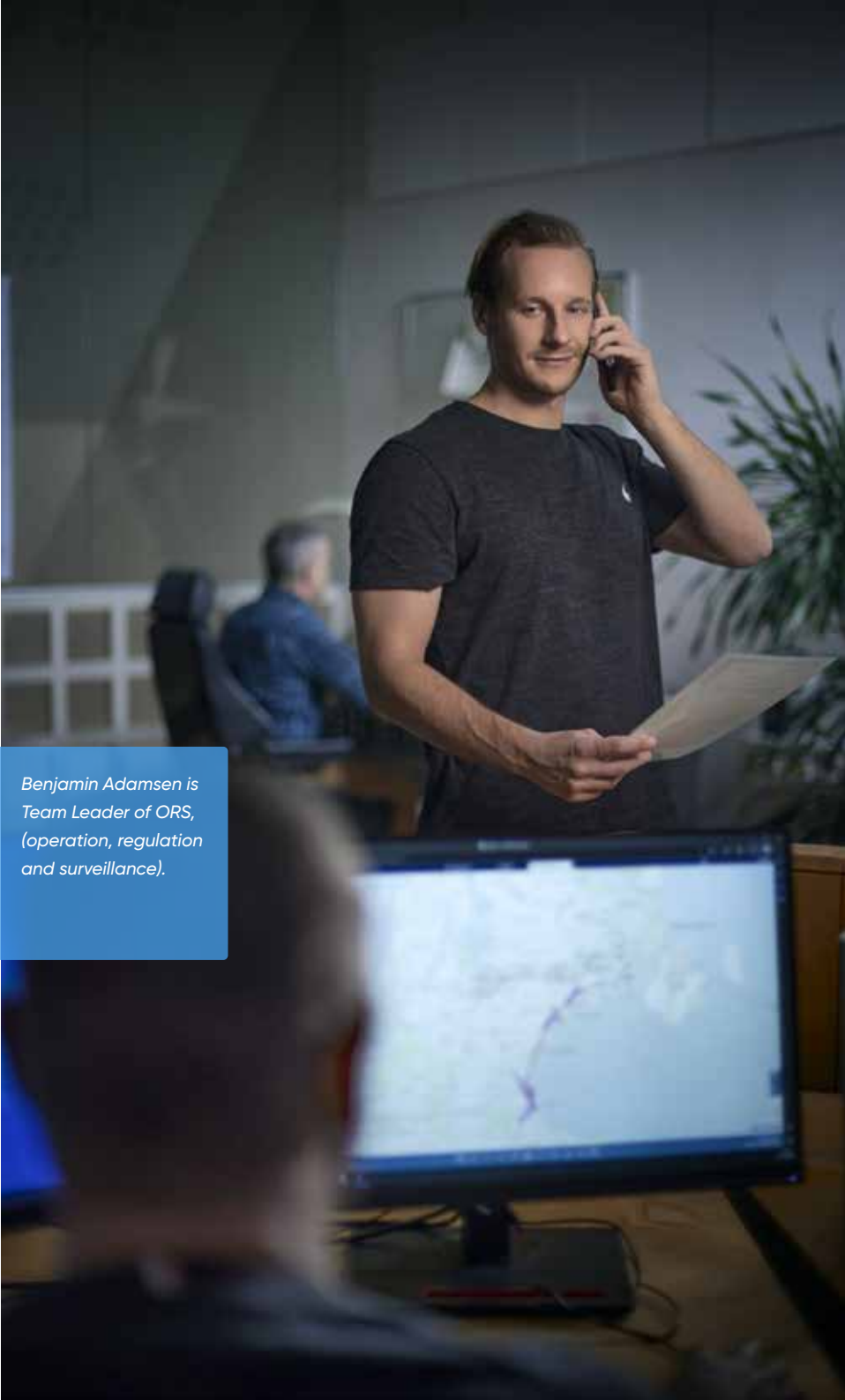
The Government has initiated a large call for tenders relating to the capturing of 400,000 tonnes CO₂/year. In 2023, it is decided who will get the job. In VEKS' area, there are two companies which are expected to make a bid – Ørsted and Vestforbrænding. If the job goes to Ørsted, it will be about utilisation of surplus heat from the CO₂ capture process at Avedøre CHP Plant. A Letter of Intent (LOI) between Ørsted and VEKS/CTR has already been signed.

Privatisation of the waste-to-energy plants and competition exposure of incineration suitable waste

On 14 February 2023, the Danish Energy Agency sent a draft bill pertaining to *A new organisation of the waste incineration sector and competition exposure of incineration suitable waste* for consultation until 14 March 2023.

VEKS receives approx. 35–40% of the heat from waste-to-energy plants and ARGO is the primary supplier. Waste heat has played a very important role to VEKS in the current supply crisis and will continue to be of high value in similar future situations. The background to this situation is that waste is not purchased at a fuel market depending on the prices at the international fuel markets, e.g. of natural gas, oil and biomass.

With the draft bill it is suggested that competition to begin with will be introduced from 2025. Some years



Benjamin Adamsen is Team Leader of ORS, (operation, regulation and surveillance).

later, a tightening which is not known beforehand and which will turn off 30% of the capacity of waste-to-energy plants in Denmark will be introduced. Alternatively, the waste-to-energy facilities may go bankrupt. In the coming 5-7 years, this model will cause great insecurity regarding which facilities are to be closed and which are to keep on operating. In this period, the companies will not be able to invest in CO₂ captures. Therefore, it is also important that the planned tightening will be announced concurrently with adoption of the Act and liberalisation of waste.

Geothermal energy

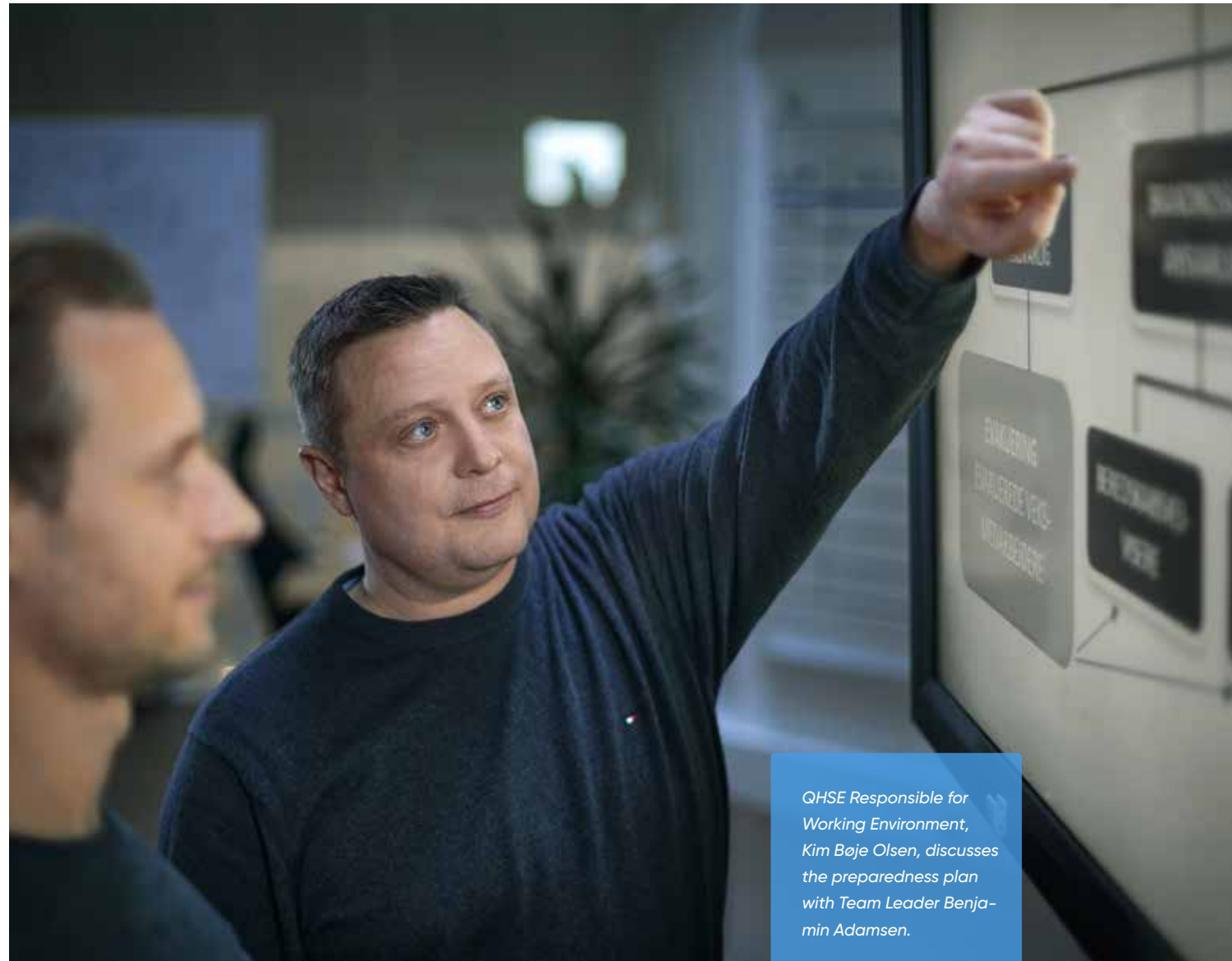
The negotiations with Innargi on geothermal energy will proceed for the most part of 2023. In 2022, CTR, HOFOR and VEKS signed a Letter of Intent (LOI). This has been replaced by negotiations where all three companies negotiate jointly with Innargi to find a favourable geothermic solution that can be included in the Greater Copenhagen district heating system.

Sustainable biomass

In accordance with the political wishes in 2012, Ørsted reorganised the heat production at the Avedøre CHP Plant from fossil fuel to certified, sustainable biomass in accordance with VEKS' requests.

As regards the long-term goal of a CO₂ neutral society, biomass must be considered an interim solution, however, requiring that the employed biomass is a certified sustainable.

A certified phasing out of the biomass must take place so other eco-friendly, cost sensible and supply secure solutions can be considered. This means that the units must be replaced by alternative technologies concurrently with discarding of the individual biomass CHP Plant units.



QHSE Responsible for Working Environment, Kim Beje Olsen, discusses the preparedness plan with Team Leader Benjamin Adamsen.

Strategy actions 2023

The future green energy system



New green sustainable heat production

VEKS' Strategic Supply Plan ●

Large heat pumps ●

Heat Pit Storages: Høje Taastrup, Roskilde ●

Geothermics ●

Carbon Capture and Power to X ●



Green peak and reserve load - implementation

Implementation of peak and reserve load strategy ●

Hvidovre Hospital - electric boiler ●

Roskilde Main Exchange - electric boiler ●



Optimum inlet temperature

Transmission system: Possibilities and limitations are investigated ●

■ Particular focus in 2023

● Awaits

● Initiated

● On the way in operation

✓ In operation/finished



Core Business

- Competitive heating prices
- On top of the economy
- A good customer experience

Service and maintenance of the transmission system ●

Organisational development and culture ●

Process-driven business ●

New head office ●

Employee development via Wholebrain ✓

Efficient core operation



District heating for as many end customers as possible in VEKS' Distribution

Køge and Tranegilde District Heating ●

Ensure the economy in connection with gas price agreements ●



Asset Management

Asset Management og risikolelse ●



We guard data

Data security and GDPR ●



Data control, analysis and artificial intelligence

Pilot project at KKV - control of NO_x emission ●

Green image



We put our own house in order "Green for real"

Implementation of environmental measures ●



To promote green district heating in the Copenhagen Region

Campaign material for Køge and Tranegilde District Heating ✓

Communication policies and strategy ●

Collaboration with the customers



Heating agreements of the future

Heat supply agreements with the customers ●

Contract negotiations ARG0, ØRSTED, VF ●



New district heating products

Models for subscription and owners are implemented ✓

Cases

The first case is an interview with CEO Morten Stobbe. The following cases bring into focus a number of projects each of which in their own special way stem from VEKS' strategy efforts – presented on the previous pages.

Case

1

VEKS leading the way is an interview with newly appointed CEO Morten Stobbe: What is his opinion on VEKS' key markers in a turbulent, political landscape? What about reliability of supply? Have we come far enough? Will VEKS still experience growth five years from now?

Case

2

The heat storages of VEKS and Høje Taastrup District Heating have just been put into operation. *Case 2 Hot water in storage* describes how the storage ensures improved utilisation of the power and heat production in the Greater Copenhagen system for the benefit of the green transition.

Case

3

Many customers on their way in Køge is focusing on the required large transition with Køge District Heating because of the fact that 8,000 private customers request district heating.

Case

4

During the well over ten years that Køge CHP Plant has been under the wings of VEKS they have succeeded in optimising the plant so that it is today far more effective compared to the time of the takeover. *Case 4 The search for improvements* describes some of the many projects.

Case 1

VEKS is leading the way

Interview with Morten Stobbe who took up the position as VEKS' CEO on 1 December 2022

The stage was set for status, but also thoughts about VEKS' future. What is the opinion of the newly appointed CEO, Morten Stobbe, about VEKS when it comes to navigating in a turbulent, political landscape? What about reliability of supply? Have we come far enough? Will VEKS still experience growth five years from now?

Next step

If you consider the government platform "Responsibility for Denmark" from a district heating point of view, several issues come to mind. Climate neutrality 2045 is replaced by the fact that Denmark should be CO₂ negative in 2050. Moreover, a task force named NEKST is established where the roll-out of district heating and more renewable energy are the most important tools in relation to reducing Denmark's natural gas consumption. Furthermore, one of the goals is that

Morten Stobbe

Morten is 56 years old and a qualified MS (engineering). He took up the position as VEKS' CEO in December 2022 – Vice President the same place from April 2016.

Fragments from his career: 12 years with HOFOR, among other things, supply manager for district heating, city gas and Amager Power Plant. Before that time, management and project management in several consultancy firms.

Morten is married to Connie Honoré Stobbe, Energy and Construction Consultant. He has two adult children, Anna and Emil, and a dog.

The bicycle plays an important role in Morten's life. Besides riding in his spare time, Morten also participates in races, in Denmark as well as abroad.



Case 1

NEKST will overcome the obstacles of the natural gas conversion and simplify the administrative regulations and executive orders delaying Denmark's ambitious climate policy.

– There is no doubt that the district heating sector will be urged to move on to the next step. In all modesty, I actually think that VEKS is already working intensely on speeding up the transition, CEO Morten Stobbe says.

All politicians agree on the fact that district heating is an important part of the solution when it comes to Denmark's goal on reducing the emission of CO₂ by 70% in 2030. However, Morten sees several national obstacles to the district heating roll-out where in particular the increasing prices of pipes, excavation and welding work will be a challenge. From a central point of view, they could, for instance, choose to postpone national construction projects, recuperate in large consortia and more specifically concentrate even more on retraining more people to be able to carry out some of the central work processes. For instance, there is a critical shortage of district heating welders.

Reliability of supply

– In the past year, many agendas have been turned upside down. We have actually not discussed reliability of supply at this level since the 70s and 80s, Morten notices.

The war in Ukraine quickly changed the world with price increases and shortage of natural gas combined with increasing power prices. The VEKS system is resilient as it is, among other things, based on multiple types of fuel: Waste, wood pellets, wood chips, biogas

and power through heat pumps/surplus heat from industry.

Moreover, VEKS has many local reserve boilers which are primarily supplied with natural gas. – Also here, we have secured the supply by soon replacing the old gas boilers with electric boilers at Hvidovre Hospital, but also by adapting more gas boilers to be able to use oil and not only natural gas. This improve the supply reliability, and also entail more gas for the private individual gas consumers, Morten explains.

The supply reliability of power is also challenged. Energinet will not at present allow decommissioning of CHP-plant, but chooses instead to keep several old units – fuelled with coal and oil – running. Furthermore, Energinet operates with the possibility of blackouts and controlled brownouts where the power is turned off in an area for a limited period of time.

– If this tendency to keep large CHP plants running continues, it may, at the end of the day, have consequences for the units supplying VEKS with heat. It makes our planning complicated, as we need to know when a plant is taken out and shut down, Morten notices.

Collaboration

Vision: *" VEKS wants to speed up the green transition and deliver efficient and sustainable energy solutions through partnerships to the benefit of our customers."*

Partnerships? – It is a great advantage that we in the Greater Copenhagen system have a tradition of strong collaborations: We share *Varmelast, Future District Heating, Energy Across Borders* (Energi på Tværs), etc., Morten points out.

The collaboration with customers

VEKS Customer Forum represents the local district heating companies and meets four times a year.

Renegotiation of heat supply agreements has started again. The core principles of local production are for instance increased. Where will we get the future heat from? How green is the heat and what should it cost? To support the work, a "Plan and Development Committee" is associated with Customer Forum. The committee combines review and discussion of technologies, including how the collaboration is going to be developed in general.

VEKS' own plan team develops and matures projects – also for the local companies.

Varmelast is a big unifying partnering between the Copenhagen metropolitan area's heating companies and the producers. It is Varmelast's job to make sure that the power and heat production is optimised so the heat always comes from the least expensive plant.'

The Future District Heating is a planning and analytical collaboration between VEKS, CTR, Hofor and Vestforbrænding which sets out the framework and recommendations for the development of district heating in the Greater Copenhagen area.

– VEKS has put a lot of effort into the mutual planning because we cannot and should not lift the green transition alone! However, we would like to lead the way and we actually have some power and projects running, Morten concludes. More information on this later.

Another partnership is VEKS' commitment in *Energy Across Borders* where they collaborate with the other district heating companies of the Copenhagen metropolitan area on a specific heat planning across the municipal and regional borders together with not least the producers. – It is no longer a marriage of convenience between the district heating companies and the producers. There are still strong and long negotiations, but we basically recognise each other to a much higher degree than ever before and we dare to be honest when expressing our need for collaboration! Most recently, several of VEKS' producers have had an extra income on the sale of electricity which VEKS' heating customers have also had a share in, Morten says.

Case 1



CEO Morten Stobbe always starts his day with a round in VEKS' departments. Besides saying good morning, he also checks his status – like here in VEKS' operation centre talking to Operations Engineer Jonathan Egebøl.

Speed up the transition

– VEKS can and will lead the way! And we do so because our owner municipalities and customers have established that we need to speed up the green transition, Morten determines.

To be a pioneering company is formulated in the owner strategy and repeated in mission, vision and VEKS Strategy 2025.

With VEKS' active role in the green transition, there will be a constant and firm focus on a healthy economic development of the company in order for the company to be able to deliver safe and stable district heating at competitive prices. This is expressed in the company strategy VEKS Strategy 2025.

A wide selection

VEKS' Strategy 2025 defines 11 strategy initiatives, including a number of project areas – please find overview on page 11. *The future green energy system* alone includes nine strategy projects where VEKS, either on its own or in collaboration with partners, explores and schedules where the heat should come from.

Case 1

– We are looking into a near future with a far wider range of production capacity. We are gradually phasing out the district heating from the central biomass-based CHP plants and waste-to-energy plants – and not just in theory: In approximately ten years, we will probably say goodbye to unit 1 of Avedøre CHP Plant. And thus, goodbye to 330MW district heating, Morten states.

Then, where should the heat come from? – We will try to answer this question in VEKS' strategic supply plan aimed at solving the puzzle so that we will still be able to deliver secure supply and eco-friendly district heating at a reasonable price, Morten remarks.

Ongoing projects

As already mentioned, several strategy projects in relation to the future green district heating are already in progress. In unit 2 of Avedøre CHP Plant, the straw-fired boiler is now separated from the main boiler which could open doors for surplus heat from Carbon Capture. From here, Ørsted may choose to store CO₂ in the underground or use CO₂ for Power to X. If the straw-fired boiler is fuelled with Carbon Capture, it will mean up to 50MW extra surplus heat to VEKS already from 2025.

The analyses in *"The Future District Heating"* show that there is 100MW surplus heat alone in the Copenhagen metropolitan area. A considerable part of this potential is data centres, but there are also other industrial sources. A good example of utilising the surplus heat is CP Kelco and VEKS' joint project which was put into operation in 2018. The surplus heat of the project heats up more than 2,000 residences. – We would really like to engage in more, similar surplus heat projects – we must collect surplus heat, Morten

declares. Therefore, VEKS is also conducting real negotiations on the utilisation of surplus heat from data centres in Høje Taastrup – perhaps also in Køge, in the long term.

Concurrently, VEKS, CTR and HOFOR have initiated negotiations with Innargi about utilising geothermal heat.

– It is not only about the large, central plants. Our strategy regarding peak and reserve load points towards far more climate friendly solutions. At present, VEKS has – as mentioned – decided to rebuild the peak load units to an electric boiler at Hvidovre Hospital. And there are probably more electric boilers on their way, Morten says.

The new production technologies based on surplus heat, carbon capture, heat pumps, electric boilers and geothermics mean that there is a need for greater flexibility and storing in the system. Thus, Høje Taastrup District Heating and VEKS' joint heat pit storage, which have just been put into service, are important contributions to "The Future District Heating" – please see case 2.

Lack of space

Several assignments have increased in number and complexity during the last 4-5 years: The roll-out of district heating in Køge and Tranegilde, several strategic negotiation processes with present and perhaps future producers of heat, multiple construction projects and increasing servicing jobs on the large transmission system – and a clear focus on the fact that VEKS should become a more process driven business.

– Most likely, we will expand the staff so that the 110 employees we have today will increase to approximately 120 at the next turn of the year. And no, it is not due to volume sickness. On the contrary, VEKS' skills and resources have to keep pace with what we are obligated to deliver, Morten ascertains – with reference to the above projects and jobs.

Already in 2020/21, the site at Roskildevej 175 was too small and they investigated the possibility of rebuilding which, however, turned out to be too expensive. VEKS temporarily solves the space problems by renting premises on the other side of Roskildevej 175 which, however, is not a permanent solution. Consequently, it has now been decided that the headquarters should be moved to a tenancy in Fabriksparken in Albertslund.

What will VEKS look like five years from now?

– At that time, we will have found the solution to where the heat should be coming from. We will be in the middle of implementing our strategic supply plans and gaining experience from the new technologies. Hopefully, Køge and Tranegilde District Heating will almost have finished the expansion so that the time has now come to operate and develop our local district heating companies and service the many thousands of new customers. The transmission system has been "upgraded" so it can deliver heat to all the new customers which the local district heating companies have connected. The system still needs to be maintained and reinforced – preferably based on systematic asset management. In five years, we will have come far with our processes and procedures which will be straight as an arrow by then. And we will also be in the middle of investigating the possibilities of binding energy collaborations and partnerships, Morten finishes.



– Most likely, we will expand the staff so that the 110 employees we have today will increase to approximately 120 at the next turn of the year. And no, it is not due to volume sickness. On the contrary, VEKS' skills and resources have to keep pace with what we are obligated to deliver, Morten ascertains – with reference to the above projects and jobs.

Morten Stobbe

Case 2

Hot water in storage

The heat pit storage of VEKS and Høje Taastrup District Heating were put into operation at the turn of the year



Operations Engineer Peder Ekelin is operations manager on duty and here he is visiting the heat pit storage of VEKS and Høje Taastrup District Heating.

Case 2



Høje Taastrup District Heating and VEKS have erected and jointly own a pit heat storage which is located at Bondehøjvej in Taastrup, close to the transmission as well as the distribution network. The storage ensures improved utilisation of the power and heat production in the Greater Copenhagen system for the benefit of the green transition.

The primary idea with the heat storage is to store the district heating when it is low-cost to produce – on the other hand, the heat from the storage is utilised when it is expensive to produce the heat.

Ground-breaking pioneer project

It is the first time in Denmark that we see this type of heat pit storage in one of the large district heating systems. The energy is added or taken on an ongoing basis depending on price, supply and demand. The storage functions as a “week heat pit storage” which differs from the existing seasonal storages where the

solar heat of the summer is stored in heat pit storages and the heat is not utilised until the heating season starts.

When the partners had to develop the storage, they used their know-how from the existing pit heat storages as a starting point. However, there were still unresolved issues. The actual idea with a week storage is new and it makes demands on the choice of materials. The higher temperatures combined with frequent charging and discharging entailed that they had to use a large amount of untested materials. Moreover, the business model and optimisation method are new. These pioneer conditions have contributed to the fact that the development project has received a subsidy of DKK 13 million –for materials development as well as a measuring programme – from EU DP which is Danish Energy Agency's pool to support development projects.

The new heat pit storage contains 70,000m³ district heating water. The extent corresponds to the length of two football fields and the width of one football field. Photo: Ioannis Sifnaios, DTU

A storage is a storage...

It is a pit heat storage; as you know, a pit/pond is a small lake. This type of thermal heat storage is the least costly way to store energy in the energy system as opposed to existing steel storage tanks and other types of storage such as stones and sand.

Both Avedøre CHP Plant and Amager CHP Plant have storage tanks which stores heat – for instance when the power is expensive. These steel tanks also control and maintain the pressure in the system and can quickly deliver large amounts of energy. However, the capacity of the tanks (Avedøre CHP Plant 24,000 m³) is limited compared to the Copenhagen metropolitan area's very large district heating system.

Unlike the tanks, the pit heat storages are not under pressure and they only contain a very small amount of expensive steel which, all in all, makes the establishment considerably cheaper.

Unlike the steel tank construction, a pit heat storage requires a lot of space which is available in VEKS' supply area at a reasonable price in the rural zone areas.

Collaboration

The storage functions as a buffer and is – in practice – an expression of sector connection between electricity and district heating. In the future, district heating will to a higher degree produce power and in a world with substantially fluctuating power prices during a day the value of heat pit storages will increase.

Both the heating companies and the producers benefit from the project which is why the producers have also contributed to the storage. For instance, Ørsted will benefit from being able to store the heat when the

Case 2

power price is high. Waste-to-energy plants, such as Vestforbrænding and ARGO, benefit from the storage, especially in the summer where the heat can be difficult to sell due to low heat consumption. CTR and VEKS benefit further from the heat pit storage, as the storage can also save local peak load in the winter and in some cases reserve load. Today, the local boilers are typically based on fossil fuels.

Refined district heating plans

It is Varmelast's job to ensure the daily optimisation of the heating system. The charging and discharging capacity are 30 MW and will contribute to refining Varmelast's district heating plans: The new storage has resulted in the fact that there is now more flexibility in the Greater Copenhagen energy system.

The heat pit storage functions as the "new handle". It is now possible to calculate when it is profitable to draw heat from the heat pit storage or when it is most profitable to store the heat – on the basis of a seven-day horizon. The producers report which heating capacities are available at the plants, and the heating plan is defined according to the cheapest heat.

From a practical point of view, the storage from the transmission system is stored and delivers heat to the system of Høje Taastrup District Heating which is big enough to receive the heat.

Untested technology – knowledge sharing

The project is an example illustrating that knowledge sharing in relation to transmission and distribution network is a very important condition for this type of projects to succeed.

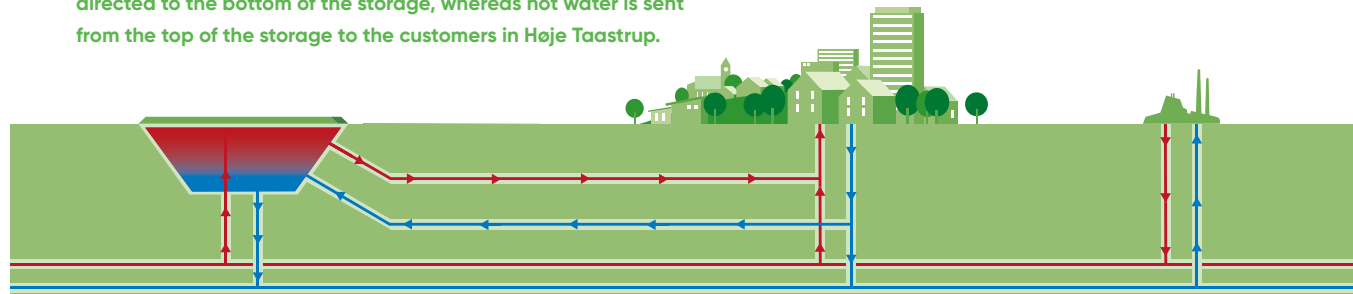


Finn Bruus
Specialist Coordinator Finn Bruus is project manager at the heat pit storage – and is specialist coordinator for project management/project model in VEKS. Finn was employed by VEKS in 2018.



Thomas Hartmann
Energy Planner Thomas Hartmann has, among other things, handled the negotiations with producers, EUDP agreements, etc. Employed by VEKS in 2017.

When the heat requirement increases, the return water is directed to the bottom of the storage, whereas hot water is sent from the top of the storage to the customers in Høje Taastrup.



Dimensions

- The storage contains 70,000 m³ water
- Length: 180 metres
- Depth: 14.5 metres
- Width: Varies between 52 metres and 72 metres

Project scope

- 70,000 m³ heat pit storage
- 130 m² underground pumping station
- 400 m² heat exchanger building
- 700 metres "charging and discharging"
- Budgeted investment: Total DKK 90 million (including EUDP support)
- Operation utility: DKK 6-7 million a year

The partners behind the project are

- Four CHP plants of a total of 2,050 MW,
- Three waste-to-energy plants of a total of 400 MW
- In the Greater Copenhagen system, reserve and peak load systems are included of a total of 1,900 MW
- Two heat accumulators of a total of 660 MW
- Two transmission companies delivering heat to a total of 26 local district heating companies in the Copenhagen metropolitan area.

Case 2

It has been a great advantage for the project group behind the pit heat storage to be able to recover know-how from other Danish seasonal storages considering construction and cover. Despite this knowledge sharing, the project group behind the heat pit storage of VEKS and Høje Taastrup District Heating also had to carry out several tests to be able to make the right technological choices and solutions.

In the process, the project ran into challenges because they were testing untried technology. They gained a lot of experience and they both changed choice of materials and cover solutions. As mentioned before, this learning process often characterises a development project which is supported by EUDP. Moreover, EUDP attach importance to being open when communicating – this both applies the good and less good know-how which are learned on the way.

All in all, the project will contribute to speed up the development within the heat pit storages which is a fast growing field within the entire district heating sector.

Liner

They knew right from the start that there is a big difference between using plastic for the pit heat storage and using steel in tanks. Steel has been tested and used for numerous purposes for an incredible number of years.

As a construction material, plastic is a much younger and less know-how-based product. And since this project involves ongoing charging and discharging, they end up having a higher average temperature of the district heating water which challenges the plastic material to a higher degree than the water in the usu-



The heat pit storage is a pioneer project. The development project has received DKK 13 million from EUDP which is the supporting pool of the Danish Energy Agency for development projects.

al seasonal storages in the decentralised district heating systems.

Consequently, the heat pit storage is equipped with a newly developed liner for the bottom and sides of the pond. The liner is specially designed for high temperatures in district heating systems over the year and can withstand a constant temperature of up to 90 degrees. During the selection process, the project's advisor, Plan Energi, has played an essential role: The liner is manufactured from PolyPropylen which is developed and customised in the Austrian innovation project gigATES. The expected life of the liner is more than 30 years at high temperatures which is tested by Linz University in Austria.

Unfortunately, there were problems with the quality of the first liner and the mounting carried out along the way. To cut a long story short: The pond did not keep tight and they had to mount a newly developed liner. This resulted in a project delay which no one could have foreseen. Moreover, the liner is mounted with a newly developed leak control.

Cover

Many decisions had to be made before they found the right cover solution. During the projecting stage, they found that several of the solar heat storages in the country have problems with their cover. In the sector, there is a great openness so they can learn from each other's good as well as bad experiences. All in all, the cover design was adjusted concurrently with the fact that the Danish Technological Institute tested different insulation materials for the cover.

The selected cover solution is designed as a diffusion-open construction which can discharge vapour

through ventilation hoods. Thus, they can prevent the vapour from damaging the insulating construction. Furthermore, it is possible to walk on the cover upon inspection.

Moreover, the cover is divided into sections ensuring that rainwater is efficiently diverted – and offering a minimum of maintenance. The heat loss from storage and cover is presumably intended to approx. 8-9%.

Constant learning

In future, the storage will have an increasing importance. Not only to utilise more wind and sun, but also to be able fulfil more types of surplus heat based on heat pumps.

They have obtained a lot of learning from the projecting and construction stage. Now awaits the collection of operation know-how. For this purpose, they will monitor the operation carefully to learn more about storage and to optimise the operation of the storage on an ongoing basis benefitting the entire system.

Moreover, a 3-year measuring programme is associated with the project. This part of the project is attended by DTU (Technical University of Denmark) together with Plan Energi, Høje Taastrup District Heating and VEKS.

All in all, the project will in the future gather – not least technological – know-how and learning which all parties involved will share with the sector nationally and abroad. An important cornerstone in a development project.

The heat pit storage will officially be opened in the middle of April 2023.

Case 3

Many customers on their way in Køge

In overall terms: What DO you do when thousands of impatient customers request district heating here and now?

Despite the fact that conversion of natural gas customers has been the central point to Køge District Heating for more than 10 years, the job has taken a new twist. When VEKS turned the first sod for Køge District Heating about ten years ago, the target group for the extension was large customers alone – customers over 300m². In the middle of 2014, the first stage of the actual district heating system and the pump and heat exchange facility was established and ready to supply the first large customers with district heating.

However, the reason why the project has taken a new twist is that approx. 8,000 customers who are primarily private customers are now queuing up to get district heating.

National climate objective

Spreading district heating is defined as an important tool in Denmark's climate objective of reducing the CO₂ emission by 70% before 2030. Politically, the ambition is also to become independent of Russian natural gas. During 2022, the geopolitical perspective in relation to reliability of supply has confirmed the transition agenda.



As regards the current natural gas customers in Køge, there is an urgent need to get district heating. They are under pressure due to the current international energy crisis which has resulted in fluctuating natural gas prices and not least great insecurity in terms of when the gas will become a scarce resource.

Positive customer experience

Green, easy and silent. This is the fundamental idea of the district heating in Køge. In particular, the notion "easy" is what the customers should experience throughout the process – and not only when the residence is heated by the district heating. Every step of

In VEKS' operation centre the district heating system from Roskilde to Hvidovre and all the way to Køge is monitored and controlled.

Case 3

the way from the customer is informed, enters into the agreement to the installation in the residence, the process must run smoothly: The customer experience should be positive.

With 8,000 new customers on their way, one of the first assignments in 2022 has, therefore, been to recruit employees and new competences. Køge District Heating is based in Køge and nine employees and not least a new head of the district heating supply have now been employed. In addition, there are dedicated communication, environment and work environment representatives and five project managers whose job is to realise the construction project – they are employed in VEKS' project team. This makes great demands on internal coordination.

The head office is located next to Køge CHP Plant, however, there is also a more "available" customer office close to the customers in the town centre of Køge. The customers should experience *availability*. This both applies if you turn up at the office to get some good advice and when Køge District Heating's customer consultant answers the telephone, but also when the project manager meets the customer at the edge of the district heating excavation.

Potential new customers receive printed sales material and are referred to Køge District Heating's website with online registration. Moreover, the customers have the opportunity to buy their district heating installation as a subscription scheme offered by Køge District Heating. This means that the customer gets a district heating unit installed and that this unit is owned and serviced (and changed if necessary) by Køge District Heating in return for a small fixed monthly payment.

Køge District Heating

Køge municipality asked VEKS to carry out the task of propagating district heating to be able to adhere to the climate plan.

The environmental benefit of the project is an annual CO₂ reduction of 40,000 tonnes.

Duration of construction:

1st wave: 2012 – 2021

2nd wave: 2022 – 2030

In 2022, 88km, including service lines, were laid out.

Køge District Heating's headquarters are situated next to Køge District Heating – moreover, an office is centrally located in the centre of Køge.

Køge District Heating is connected to VEKS' transmission.



Thomas Hopp

Thomas Hopp started in VEKS in the middle of June 2022 and is programme owner of the roll-out of Køge and Tranegilde District Heating.

Tempo, tempo

There is a great interest in getting district heating to Køge. The overall control is based on an overall plan, a so-called "master plan", that defines in which areas of Køge they will first roll out district heating to the 8,000 new customers. Therefore, the campaign is carried out in stages. The first sales campaign was launched in the spring of 2022 in a residential area in the northern part of Køge with 1,700 potential new customers. The support was sufficient for Mayor Marie Stærke and the head of the district heating supply, Thomas Hopp, to turn the first sod for the main line (second wave) in January 2023 – see page 23.

The second sales campaign in the autumn of 2022 was aimed at the citizens in the town centre of Køge. In a few months, sufficient registrations were received for the project to be realised. Here, the digging work will be initiated in the autumn of 2023.

As much district heating as possible at competitive prices for as many customers as possible. The timetable as well as the price are, however, pressed by a hard-pressed labour market, inflation and sharp increases on pipes.

Large customers and new buildings

The strategy for dealing with large customers differs significantly from the private customer strategy. Large customers are contacted individually, as they are professional consumers whose individual terms and conditions are very different. Besides the enterprises and institutions of Køge, the conditions of housing associations are also different and individual: For instance, decisions regarding conversion to district heating should respect the tenants' democracy. Therefore, the employees of Køge District Heating regularly partici-

pate with input in housing associations, co-operative dwellings, etc. – sometimes in cooperation with the municipality.

Besides extending the district heating for single-family houses, district heating is also established for new buildings. Finally, a service line will be connected to new small customers in the areas where the district heating is already established, but only supplies the present large customers. This "densification" takes place on an ongoing basis.

Local identity

When district heating is to be rolled out to private customers, we need to hold fast to the local Køge identity. More specifically, it is about using the name Køge District Heating only (and leave out the group name "VEKS"). As regards district heating, identification and principle of subsidiarity make sense to the local citizen of Køge.

Køge municipality is a very important partner in the roll-out of district heating. There is a great political goodwill and a good relation has been established where all parties pull in the same direction.

Four times a year, participants from the committee meet together with representatives of VEKS' CEO and management in the political reference group. This is supplemented with regular orientation and coordination meetings between strategy consultants, employees from the administration and Køge District Heating.

Køge District Heating focuses on avoiding disappointed customers. As far as possible, the municipality seeks to avoid dissatisfied citizens. Joint efforts result in mutual understanding.

Case 3

Turning the first sod, 1st wave:

The opening of Køge District Heating, 29 May 2012.

Finn Aaberg, VEKS' chairman at the time, praised the fast decision process and pointed out that it is only of use if words are put into action: "Or in other words - in brief - this was the opportunity to realise the climate and energy policy which we all agree is the road ahead, but at times can be difficult to bring from political toasts to reality."

VEKS' chairman at the time, Finn Aaberg, and Køge's Mayor, Marie Stærke. PHOTO: VEKS



Head of Køge District Heating, Thomas Hopp, and Køge's Mayor, Marie Stærke. PHOTO: VEKS

Turning the first sod, 2nd wave

On 18 January 2023, Køge got closer to district heating for even more citizens. Mayor Marie Stærke and Head of Supply Thomas Hopp each turned the first sod for the 2nd wave of district heating. In Nylands-kvarteret, a new big main line is being established. The line will supply a large residential area with 1,850 residences around Nylandsvej and an industrial area in Køge Nord. In her speech, Marie Stærke had focus on the environment: *We must think in terms of green and sustainable solutions wherever we can. The roll-out of district heating in Køge municipality is speeded up. Many people might think that it is going too slow, however, Køge District Heating is doing what is possible which we can all tell today.*

Since 2012, Køge District Heating has been visible in Køge's townscape and has 800 customers for the time being. Now, the project's second wave of district heating supply is rolling in Køge with a far greater perspective. It includes 8,000 new customers who cannot wait to have district heating! Thomas Hopp drew attention to the customers: In addition to the fact that it is a large planning and construction project, it is also a large customer project. *The future district heating customer often has many questions and considerations. At Køge District Heating we are ready to give information and advice so that the connection to district heating at the individual customer becomes easy and trouble-free.*

Case 4

The search for improvements

Many optimisation projects have been realised at VEKS' CHP plant in Køge

During the well over ten years that Køge CHP Plant has been under the wings of VEKS, the plant has not exactly aged gracefully but appears to be far more effective today compared to the time of the takeover. Over the years, the overall aim has always been to utilize the CHP plant a little more. Many efficiency improvements have contributed thereto en route.

Some years ago, a strategy project especially shed light on two general focus areas: Close unit 7 and establish flue gas condensation in unit 8.

Boiler 7 was scrapped

After 35 years of operation, unit 7 of Køge CHP Plant was all worn out. With time, the operation and maintenance of the unit had become expensive and it made no sense to rebuild the boiler or upgrade the operation. Even though the original investments were amortised long ago, the continued operation of the unit would involve a direct loss.

Therefore, VEKS' Board of Directors decided to scrap unit 7. In 2022, the demolition work started. The first step was to separate unit 7 and unit 8 which was operated independently, however, the infrastructure was

mutual. Therefore, all infrastructure had to be separated and adjusted so that unit 8 would not be disturbed in connection with the demolition of unit 7. The next step was an analysis along with directions as to how to get rid of the unit in a reasonable way – primarily focusing on environmentally harmful substances. The plant needed purification and cleaning and oil, fuel residues and ashes had to be drained off before it was possible to initiate the demolition of boilers and turbine. The scrapping is expected to be completed in spring 2023.

However, the outer frame of the unit is still there. VEKS' strategy includes checking the possibilities of producing a new green district heating. The new technologies could be seawater heat pumps, electric boilers, etc.

The building's infrastructure in the form of power, district heating and sea water connections will thus also be preserved.

In the overall context, the closing down of unit 7 moreover contributes to VEKS' long-term strategy on phasing out the biomass.

Energy in hot smoke

Next to the soon-to-be-empty unit 7 building stands unit 8. This unit is a more modern unit which was constructed in 1998 and has a life expectancy till 2040.

Originally, unit 8 did not produce district heating as Køge did not have a district heating system. The district heating system did not see the light of day until VEKS established Køge District Heating – please see case 3. Therefore, VEKS first reconstructed unit 8 to a back pressure facility with combined power and heat production.

Many reconstructions and efficiency improvements have already been completed. However, there was still room for a special energy-saving project which to date has been the most comprehensive one. A flue gas condensation system can convert the energy in the flue gas from the chimney of unit 8 to district heating. *But what is the process?*

In brief, VEKS' flue gas condensation project makes it possible to recover large amounts of heat from flue gas. If you lower the temperature in the gas from the present 130-140 to 30 degrees and recover the heat, you will gain much from it.

In practice, the flue gas condensation takes place in the tower by the hot gas passing plastic objects with a large surface simultaneously with the gas getting watered with the district heat water – literally in the form of two giant showers. Thereby, the heat in the gas is converted into hot water for the benefit of VEKS' customers – including the district heating customers in Køge.



Ulrik Jørgensen

Since VEKS' takeover in 2012, the Power Plant Manager of Køge CHP Plant, Ulrik Jørgensen, has been the person with ultimate responsibility. Before he started at Køge CHP Plant, Ulrik maintained the transmission system in VEKS' operations centre, worked as heat planner at Varmelast, etc.



Dan Skibsted

Often, large energy-saving projects at Køge CHP Plant have been managed by Project Responsible Dan Skibsted, employed in 2016. Dan has not least been the head of the previously mentioned flue gas condensation project. However, he has for instance also managed a large work environment project when the control room of the plant was totally reconditioned some years ago.

Case 4

This flue gas condensation process lowers the temperature to 50 degrees, however, there is more energy left! An extra heat pump handles the job of lowering the temperature with another 20 degrees – among others because the phase shift from steam to water releases a large amount of energy in this actual temperature range. Finally, the gas can be sent out through the chimney, 30 degrees hot.

In total, the CHP plant will produce more heat with the same amount of fuel. The surplus heat from the new flue gas condensation system will alone contribute to what corresponds to heating of approx. 5,400 residences per year. Thus, the project also reduces the district heating price in overall terms.

A very profitable added value of the project is the production of process water. The flue gas condensation contains water vapours which are out condensed by cooling. Instead of discharging the water to a drain as a residual product, VEKS has decided to reuse the water for boiler and district heating system. For this process, a complicated purification plant had to be established which in return has resulted in a profusely reduced consumption of drinking water.

Moreover, the production of process water through the flue gas condensation system can be produced far cheaper than the closest alternative.

The environment also wins as the gas is better purified than previously thanks to the new cooling system.

The whole flue gas condensation project was commissioned by the turn of the year 2022/2023. The price is approx. DKK 82 million with a repayment period of five years.

Black oil out!

Fuel oil as supportive fuel has long been a necessary evil at Køge CHP Plant. Fuel oil is a very polluting product and did not harmonise well with the otherwise green, biomass-fired CHP plant. However, without supportive fuel the dust burners cannot be turned on.

Fuel oil is dirty, difficult to handle, emits much sulphur and CO₂, has a thick substance which needs to be heated with steam and is ignited by way of bottled gas. In addition, the environmental approval from Køge Municipality would soon expire. Therefore, the hunt for a green and reliable alternative was initiated.

Among the possibilities were light oil and natural gas which do not harmonise with VEKS' strategy on phasing out fossil fuels and working with new technologies. Biofuel is still not very prevalent, however, plasma turned up as a green, interesting alternative. It became a pioneer project as Køge CHP Plant took on the role of first mover as the system is invented and developed for the plant.

But what is the technique behind? The solution is based on plasma: Air and power. Two electrodes create the flame which ignite the grounded wooden pellets which again ignite the dust burner.

It required a number of tests before the new ignition burner system on bio and plasma was developed. In the autumn of 2022, the test burner was turned into a permanent installation. The price for the total project amounts to DKK 4.6 million. The gain is both a reduced energy consumption and a considerably lower environmental impact.

In addition, the unit's efficiency is improved as it in-



VEKS' "homemade" mobile exchanger also forms part of the preparedness. It functions as an alternative to the mobile boiler which is usually used when considerable and long-term servicing work is on the way. Several of the local district heating companies in VEKS' supply area have borrowed the boiler in connection with planned repairs.

involved a large amount of energy when fuel oil was used to heat up the oil.

The surplus heat from heated lubricating oil

Køge CHP Plant uses lubricating oil to operate the turbine in unit 8. If the oil is not cooled down, it can both stop the turbine and expose the turbine to unnecessary wear. Previously, the hot oil was cooled down (in a closed system) by means of water from Køge Bugt.

A new system has replaced the old seawater cooling system where the heat is recovered from turbine lubricating oil and other components. The energy in the retrieval equals approx. 4,750 Mwh per year – or the heat requirement of 250 residences. The heat pump increases the temperature of the cooling water so it can be used in the system of Køge District Heating. The new heat pump system neither generates noise nor vibrates. For safety reasons, KKV has maintained the sea water system as a backup in case the heat pump breaks down or at start-up of the turbine. The repayment period of the project is 6.5 years.

Good enough is not good enough!

The better the energy is utilised, the less fuel is needed! Benefits district heating price and environment.

Biofuel

The fuel of the plant is certified biomass and residual products from the neighbouring enterprise, Junckers Industrier.

ACCOUNTS

Operations Engineer Peder Ekelin is the operations manager on duty and here he is on his way down into the underground pump building by VEKS' and Høje Taastrup District Heating's new heat pit storage.

VEKS – Profit and loss account

DKK '000	2022	Budget 2022	2021
Net sales	1,379,633	1,248,748	1,342,850
Production and heat purchase costs	-1,291,415	-1,172,364	-1,220,239
Gross profit	88,218	76,383	122,611
Transmission costs	-72,180	-65,094	-60,488
Distribution costs	-36,125	-33,973	-32,683
Administrative costs	-52,982	-41,880	-38,766
Result from primary operations	-73,069	-64,563	-9,326
Other operating income	36,246	35,059	113,063
Other operating expenses	-140	-30	-72
Result before financial items	-36,963	-29,534	103,665
Financial income	1,125	2,153	1,469
Financial costs	-19,724	-20,060	-19,193
Year-end result	-55,562	-47,441	85,941

Statement of profit or loss balance pursuant to the Danish Heat Supply Act

Årets resultat

VEKS Køge CHP Plant, production	-7,972	-7,972	7,972
VEKS Køge District Heating, distribution	-16,972	-7,976	-7,427
VEKS Tranegilde District Heating, distribution	-2,472	-3,547	-506
VEKS Gasmotor, Solrød	0	0	0
VEKS Transmission	-28,146	-27,946	85,902
	-55,562	-47,441	85,941

Adjustments

Reversal of small acquisitions recognised as an expense in accordance with the above-mentioned information	2,000	1,320	944
Reversal of operating depreciation	119,061	121,312	110,070
Reversal of profits from the sale of assets	0	0	0
Reversal of allocated holiday pay, flex time and public servant pension	-714	0	-7,020
Depreciation under the Danish Heat Supply Act	-98,003	-98,169	-192,615
Year-end result pursuant to the Danish Heat Supply Act	-33,218	-22,978	-2,680

Working balance reserve (excess cover) until 2012.	0	0	87,727
Surplus/deficit transferred from previous years	129,879	2,978	44,831
Profit or loss balance, year-end pursuant to the Danish Heat Supply Act	96,662	-20,000	129,878

VEKS – Comments on the profit of the year

VEKS in total 2022 compared to budget

VEKS' net loss for the year amounts to DKK 56 million which is DKK 8 million lower than expected.

The revenue amounted to DKK 1,380 million which is DKK 130 million higher than budgeted. The additional sale is primarily due to the fact that power has been sold for DKK 86 million more than budgeted at Køge CHP Plant. Moreover, the sale to CTR is DKK 77 million over budget. The sale to CTR has no impact on VEKS Transmission's customers, as the sale is at cost and the production and costs related to heat purchase are thus correspondingly higher than budgeted. This corresponds to a reduced sale to VEKS Transmission customers for DKK 50 million due to the fact that 2022 was a warm year.

In overall terms, the gross profit is DKK 11 million better than budgeted. The considerable income from the sale of power at ARGO and Køge CHP Plant has to a great extent contributed to reducing the prices. In return, the prices of biomass have increased which has made the heat purchase from Avedøre CHP Plant considerably more expensive. Furthermore, the increasing prices of fuel for peak loads increased the costs for peak load distinctively.

The operating expenses total DKK 20 million over budget. Acute servicing of the transmission system amounted to DKK 6 million more than budgeted and DKK 3 million is spent on a conversion project. The large addition project in Køge has resulted in the fact that the operating expenses amounted to DKK 6 million over budget. Moreover, there was an additional consumption in several areas due to higher activities and increasing prices.

VEKS in total 2022 compared to 2021

The net profit for the year is DKK 142 million lower compared to 2021. The gross profit was DKK 34 million lower, primarily due to lower heat purchase costs in 2021. The operating expenses is DKK 29 million higher in 2022 compared to 2021. This is due to extra expenses for acute servicing of the transmission system, increasing activities in connection with the extension of Køge District Heating and a generally increasing activity level which means that the number of employees has increased by 11%.

Furthermore, CO₂ quotas at a value of DKK 107 million were sold in 2021, whereas quotas at a value of DKK 30 million were sold in 2022.

Insecurity in connection with recognition or measuring

During the last 15 years, VEKS has taken an active part in the development of geothermal heat and is co-owner of a geothermal test plant in Amager (HGS). For various reasons, the plant has been on hold since 2018, however, although the plant is put on hold, it is expected that the plant may contribute to test and development of geothermics in the future. At the moment, there is ongoing dialogue with interested parties that may want to take over the plant. Therefore, there is some uncertainty about the value at which the plant is entered in the accounts. Den bogførte værdi udgør 19 mio. kr. pr 31/12-2022.

Expectations for 2023

VEKS budgets with an overall profit of DKK 33.3 million in 2023.

Balance pr. 31 december

DKK '000	2022	2021
Assets		
Tangible fixed assets		
Intangible fixed assets		
Captacity rights	326,382	340,820
Ongoing projects	0	1,531
Intangible fixed assets, total	326,382	342,352
Tangible fixed assets		
Land and buildings	13,210	7,425
Production facility	209,380	229,263
Transmission facility	574,939	552,210
Administration facility	4,368	2,659
Distribution facility	728,538	728,557
Ongoing projects	162,413	139,048
Tangible fixed assets, total	1,692,848	1,659,163
Financial fixed assets		
Securities	25	25
Long-term debts, VEKS' loan scheme	4,710	5,572
Financial fixed assets, total	4,735	5,597
Fixed assets, total	2,023,965	2,007,112
Current assets		
Stocks		
Fuel stocks	30,814	11,637
Spare part stocks	8,969	1,058
Stocks, total	39,782	12,695
Debtors		
Amounts owed from sales and services	261,823	218,566
Other debtors	19,073	19,498
Prepaid costs	30,258	29,473
Debtors, total	311,153	267,537
Current assets, total	350,936	280,232
Assets, total	2,374,901	2,287,343

DKK '000	2022	2021
Liabilities		
Capital and reserves		
Invested capital	10,217	9,875
Net loss for the year (profit or loss balance) pursuant to the Danish Heat Supply Act	-96,662	-129,878
Accumulated profit in relation to the Danish Financial Statements Act	168,194	223,756
Capital and reserves, total	81,749	103,753
Provisions		
Public servant pension liabilities	2,313	4,181
Provisions, total	2,313	4,181
Creditors		
Long-term liabilities		
Loan capital and construction credit	1,544,357	1,570,148
Long-term liabilities, total	1,544,357	1,570,148
Short-term debts		
Loan capital and construction credit, short-term share	293,153	261,609
Credit institutions	19,454	7,470
Suppliers of goods and services	309,434	190,517
Provisions for holiday allowance and flex time	8,481	7,326
Excess cover – balance, consumers	96,662	129,879
Other creditor	19,299	12,460
Short-term debts, total	746,483	609,261
Creditors, total	2,290,840	2,179,409
Liabilities, total	2,374,901	2,287,343

VEKS Transmission – Profit and loss account

DKK '000	2022	Budget 2022	2021
Transmission, fixed tariff	388,077	382,077	400,427
Transmission, variable tariff	574,335	624,341	573,637
Transmission, sales CTR	201,717	124,779	191,805
Transmission, other income	45,883	35,978	39,121
Revenues, in total	1,210,012	1,167,175	1,204,991
Production costs, excl, depreciation	-104,458	-67,153	-66,942
Production costs, depreciation	-42,120	-43,343	-41,011
Heat purchase costs	-1,004,563	-1,010,024	-1,023,177
Production and heat purchase costs	-1,151,140	-1,120,520	-1,131,129
Gross profit	58,873	46,656	73,862
Transmission costs, excl, amortisation	-44,841	-36,771	-35,113
Transmission, amortisation	-27,339	-28,323	-25,375
Administrative expenses	-40,852	-35,282	-31,092
Net profit or loss for the year	-54,159	-53,721	-17,718
Other operating income	34,882	34,011	112,122
Result before financial items	-19,277	-19,710	94,404
Financial income	809	1,173	1,033
Financial costs	-9,678	-9,409	-9,535
Year-end result	-28,146	-27,946	85,902

Statement of profit or loss balance pursuant to the Danish Heat Supply Act

Year-end result	-28,146	-27,946	85,902
Adjustments			
Reversal of small acquisitions recognised as an expense	1,113	950	527
Reversal of operating depreciation	71,097	73,188	67,911
Reversal of allocated holiday pay, flex time and public servant pension	-1,258	0	-6,439
Depreciation under the Danish Heat Supply Act	-66,026	-66,192	-148,175
Year-end result pursuant to the Danish Heat Supply Act	-23,220	-20,000	-274
Working balance reserve (excess cover) until 2012.	0	0	87,727
Surplus/deficit transferred from previous years	123,789	0	36,336
Profit or loss balance, year-end pursuant to the Danish Heat Supply Act	100,569	-20,000	123,789

VEKS Transmission – Comments on the profit of the year

The net loss for 2022 was a loss totalling DKK 28 million which is as budgeted expected. The outcome is DKK 114 million lower compared to 2021.

The sale to VEKS Transmission's customers was 8,417 TJ against the budgeted 9,372 TJ and a sale of 9,094 TJ in 2021. The reduced sale is due to a hot year.

The sale to CTR was DKK 77 million higher than budgeted. The sale to CTR has no impact on VEKS Transmission's customers, as the sale is at cost and the production and costs related to heat purchase are thus correspondingly higher than budgeted.

The variable production and heat purchase costs (pool price) of VEKS Transmission's customers amounted to DKK 70.53/GJ in 2022 relative to a budget of DKK 68.94/GJ which gives additional costs of DKK 13 million. The considerable income from the sale of power at ARGO and Køge CHP Plant has to a great extent contributed to reducing the prices. In return, the prices of biomass have increased which have made the purchase from Avedøre CHP Plant considerably more expensive. Furthermore, the increasing prices of fuel for peak loads increased the costs for peak load distinctively. In 2021, the pool prices amounted to DKK 67.99/GJ.

The gross profit for 2022 is all in all DKK 12 million better than budgeted. The incremental value of the heat purchase of DKK 13 million will be offset by adjustments of the heat purchase from 2021. Moreover, there are savings of DKK 4 million on fixed payments to Køge CHP Plant. The rest of the deviation consists of several minor items.

In 2022, the transmission costs amounted to DKK 8 million higher than budgeted and DKK 10 million higher compared to 2021. The primary explanation is that the expenses for acute maintenance have amounted to DKK 6 million higher than budgeted and DKK 5 million more compared to 2021. In 2022, more money was, moreover, spent on attorney assistance for supply processes and on Varmelast expenses.

In 2022, the administration costs were DKK 6 million over budget and DKK 10 million higher compared to 2021. Compared to budget, DKK 3 million was spent on a construction project and more employees have moreover been employed: primarily plan and project employees. Compared to 2021, it is the same explanations describing the deviations compared to budget. Furthermore, DKK 2 million more was spent on IT costs.

Other operating income is DKK 77 million lower compared to 2021 which is due to the fact that CO₂ quotas were sold for DKK 30 million in 2022 and DKK 107 million in 2021.

Køge CHP Plant - Profit and loss account

DKK '000	2022	Budget 2022	2021
Sale of electricity	117,707	31,977	64,666
Sale of heating, fixed tariff	49,406	53,035	58,319
Sale of heating, variable tariff	-17,368	41,397	29,591
Revenues, in total	149,745	126,409	152,576
Fuel	-92,425	-61,197	-86,671
Amortisation	-17,366	-17,350	-11,908
Other production costs	-42,349	-51,003	-40,684
Production and heat purchase costs	-152,140	-129,550	-139,262
Gross profit	-2,395	-3,141	13,314
Administrative costs	-4,869	-3,724	-4,031
Result from primary operations	-7,264	-6,865	9,283
Other operating income	1,364	1,040	940
Result from primary operations	-5,899	-5,825	10,223
Financial income	22	0	0
Financial costs	-2,094	-2,148	-2,251
Year-end result	-7,972	-7,972	7,972

Statement of profit or loss balance pursuant to the Danish Heat Supply Act

Year-end result	-7,972	-7,972	7,972
Adjustments			
Reversal of small acquisitions recognised as an expense	406	350	390
Reversal of operating depreciation	17,366	17,350	11,908
Reversal of allocated holiday pay, flex time and public servant pension	122	0	-517
Depreciation under the Danish Heat Supply Act	-10,271	-10,271	-20,429
Year-end result pursuant to the Danish Heat Supply Act	-349	-544	-676
Surplus/deficit transferred from previous years	-148	544	528
Profit or loss balance, year-end pursuant to the Danish Heat Supply Act	-497	0	-148

Køge CHP Plant - Comments on the profit of the year

The net profit for the year for Køge CHP Plant is as budgeted, as the earnings from VEKS Transmission and Junckers are always adjusted in relation to the amount of expenses available for producing the heating sold. A decreased/additional consumption of fixed expenses will be adjusted in the regular charging to VEKS Transmission and a deviation of the variable costs/income will be adjusted in the variable contribution.

In 2022, the sale of power was 67,890 MWh compared to a budgeted sale of 64,251 MWhs and a sale of 78,711 MWh in 2021. In 2022, the average price of the sale of power was DKK 1,689/Mwh which is DKK 1,233/Mwh higher than budgeted and DKK 1,017/Mwh more compared to 2021. In 2022, power subsidies were paid out for the power production in the first 3 months – contrary to the whole year in 2021 which means that power subsidies for 2022 were DKK 8.9 million lower compared to 2021. All in all, this resulted in the fact that the revenues on selling power were DKK 85.7 million higher than budgeted and DKK 53.0 million higher compared to 2021.

The sale of heat to VEKS Transmission was 945 TJ which is 105 TJ more than budgeted and 71 TJ less compared to 2021. The changes are due to the fact that the plant has been prioritised more by Varmelast in 2022 than expected – and less compared to 2021.

The high revenues on electricity mean that the total average price per GJ which is charged by VEKS Transmission and Junckers in 2022 only totals DKK 30.17/GJ relative to the budgeted DKK 95.39/GJ and a price of DKK 76.24/GJ in 2021.

Other production costs amount to DKK 8.7 million under budget which is due to the fact that the demolition of unit 7 was not finished in 2022 and a large part of the expenses will not incur until 2023.

VEKS Gasmotor, Solrød - Profit and loss account

DKK '000	2022	Budget 2022	2021
Sale of electricity	14,120	33,145	26,775
Sale of heating, variable tariff	5,623	8,976	6,825
Revenues, in total	19,743	42,121	33,600
Fuel	-15,506	-37,858	-29,351
Amortisation	-1,578	-1,578	-1,578
Other production costs	-1,659	-1,864	-1,861
Production and heat purchase costs	-18,743	-41,301	-32,790
Gross profit	1,000	820	810
Administrative costs	-537	-383	-344
Result from primary operations	463	437	466
Other operating income	-25	-17	-19
Result from primary operations	438	420	448
Financial costs	-438	-420	-448
Year-end result	0	0	0

Statement of profit or loss balance pursuant to the Danish Heat Supply Act

Year-end result	0	0	0
Adjustments			
Reversal of operating depreciation	1,578	1,578	1,578
Depreciation under the Danish Heat Supply Act	-1,574	-1,574	-1,578
Year-end result pursuant to the Danish Heat Supply Act	4	4	0
Surplus/deficit transferred from previous years	-4	-4	-4
Profit or loss balance, year-end pursuant to the Danish Heat Supply Act	0	0	-4

VEKS Gasmotor, Solrød - Comments on the profit of the year

In 2022, the production of the gas engine was affected by the increasing natural gas prices. The natural gas prices reached a level where it would be more profitable for Solrød Biogas to process the gas and sell it to the natural gas grid relative to burning the biogas in VEKS' gas engine.

In 2022, the production was therefore 32,104 GJ (37%) less than budgeted for 2022. At the same time, the power prices were 35% lower than budgeted. The reduced operation resulted in a revenue of DKK 22.4 million lower than budgeted and DKK 13.9 million lower compared to 2021.

The lower revenues will be counterbalanced by a lower settlement price to Solrød Biogas for the purchase of fuel. Compared to the budget, the settlement was thus DKK 22.3 million lower than budgeted in 2022 and the settlement was DKK 13.8 million lower compared to 2021.

Tranegilde District Heating – Profit and loss account

DKK '000	2022	Budget 2022	2021
Net sales	26,641	25,567	26,246
Production and heat purchase costs	-15,644	-16,043	-14,265
Gross profit	10,998	9,524	11,980
Distribution costs	-1,877	-1,734	-1,102
Administrative costs	-1,414	-968	-1,271
Depreciation	-7,681	-7,881	-7,622
Result from primary operation	25	-1,059	1,987
Other operating expenses	-24	-13	-36
Result before financial items	1	-1,072	1,951
Financial income	121	250	167
Financial costs	-2,593	-2,724	-2,624
Year-end result	-2,472	-3,547	-506

Statement of profit or loss balance pursuant to the Danish Heat Supply Act

Year-end result	-2,472	-3,547	-506
Adjustments			
Reversal of operating depreciation	7,681	7,881	7,622
Depreciation under the Danish Heat Supply Act	-5,668	-5,668	-6,543
Year-end result pursuant to the Danish Heat Supply Act	-458	-1,333	572
Surplus/deficit transferred from previous years	4,255	1,333	3,683
Profit or loss balance, year-end pursuant to the Danish Heat Supply Act	3,797	0	4,255

Tranegilde District Heating – Comments on the loss of the year

The net loss for 2022 amounted to DKK 2.5 million which is DKK 1.1 million better than budgeted and DKK 2.0 million lower compared to 2021.

2022 became considerably warmer than budgeted and in 2021. Measured in degree days, it has been 11% warmer in 2022 compared to 2021. In 2022, the sale was 44,117 MWh compared to a budgeted sale of DKK 43,300 MWh and DKK 47,197 MWh in 2021.

The gross profit is DKK 1.5 million higher than budgeted in 2022 which is due to the increased sale. Compared to 2021, the gross profit is DKK 1 million lower. The bad result is due to the reduced sale and the fact that the fixed payment for heat purchases with VEKS Transmission has increased by DKK 1.3 million. This is counterbalanced by a 7% increase in the selling prices to customers on the natural gas rate.

The increase in distribution and administration expenses is due to the fact that Tranegilde District Heating has increased the number of employees and activities. At the end of 2022, Tranegilde District Heating had approx. 500 customers.

Køge District Heating – Profit and loss account

DKK '000	2022	Budget 2022	2021
Net sales	54,368	59,662	53,137
Production and heat purchase costs	-34,626	-36,952	-30,492
Gross profit	19,742	22,710	22,645
Distribution costs	-5,228	-3,042	-2,908
Administrative costs	-5,310	-1,523	-2,028
Depreciation	-21,339	-21,315	-21,052
Result from primary operations	-12,134	-3,170	-3,344
Other operating income	0	8	0
Other operating expenses	-91	0	-17
Result before financial items	-12,226	-3,162	-3,360
Financial income	436	544	269
Financial costs	-5,183	-5,358	-4,336
Year-end result	-16,972	-7,976	-7,427

Statement of profit or loss balance pursuant to the Danish Heat Supply Act

Year-end result	-16,972	-7,976	-7,427
Adjustments			
Reversal of small acquisitions recognised as an expense	481	20	27
Reversal of operating depreciation	21,339	21,315	21,052
Reversal of allocated holiday pay, flex time and public servant pension	422	0	-64
Depreciation under the Danish Heat Supply Act	-14,464	-14,464	-15,890
Year-end result pursuant to the Danish Heat Supply Act	-9,194	-1,105	-2,302
Surplus/deficit transferred from previous years	1,988	1,105	4,290
Profit or loss balance, year-end pursuant to the Danish Heat Supply Act	-7,207	0	1,988

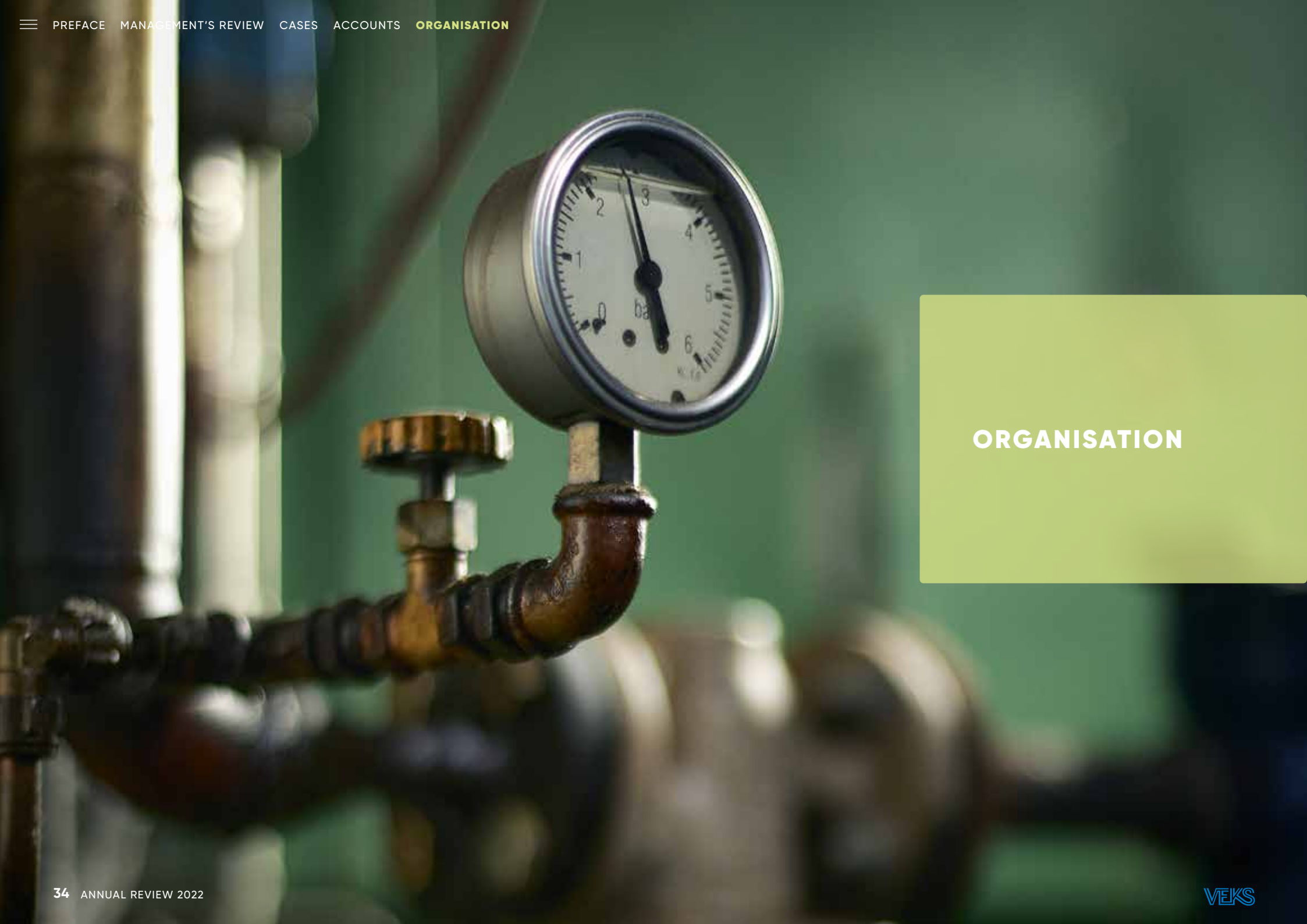
Køge District Heating – Comments on the loss of the year

The net loss for 2022 amounted to DKK 17.0 million which is DKK 9 million lower than budgeted and DKK 9.5 million lower compared to 2021.

2022 became considerably warmer than budgeted – and in 2021. Measured in degree days, it has been 11% warmer in 2022 compared to 2021. The sale ended at 98,935 MWh compared to a budgeted sale of DKK 112,486 MWh. Besides the warmer weather, the reduced revenue is also due to the fact that fewer new customers were connected than expected. In 2021, the sale was 106.965 MWh.

In 2022, the gross profit was DKK 3 million under budget and DKK 3 million lower compared to 2021. Compared to budget, the deviation is due to the warm weather. Compared to 2021, the explanation is also that the fixed payment for heat purchase with VEKS Transmission has increased by DKK 3 million. This is counterbalanced by the fact that the selling prices for customers on the natural gas rate have increased by 7%.

The big increase in the distribution and administration expenses is due to the generally higher activity in connection with the addition project in Køge. Especially the expenses for organising new office premises, customer office and storage combined with the purchase of new IT equipment and adjusting programme/website have entailed considerable expenses. Moreover, the number of employees has increased from 3 to 8 persons during 2022. This is due to the fact that up to 8,000 premises in Køge must be converted from natural gas to district heating – compared to the fact that there were approx. 600 customers in 2022.



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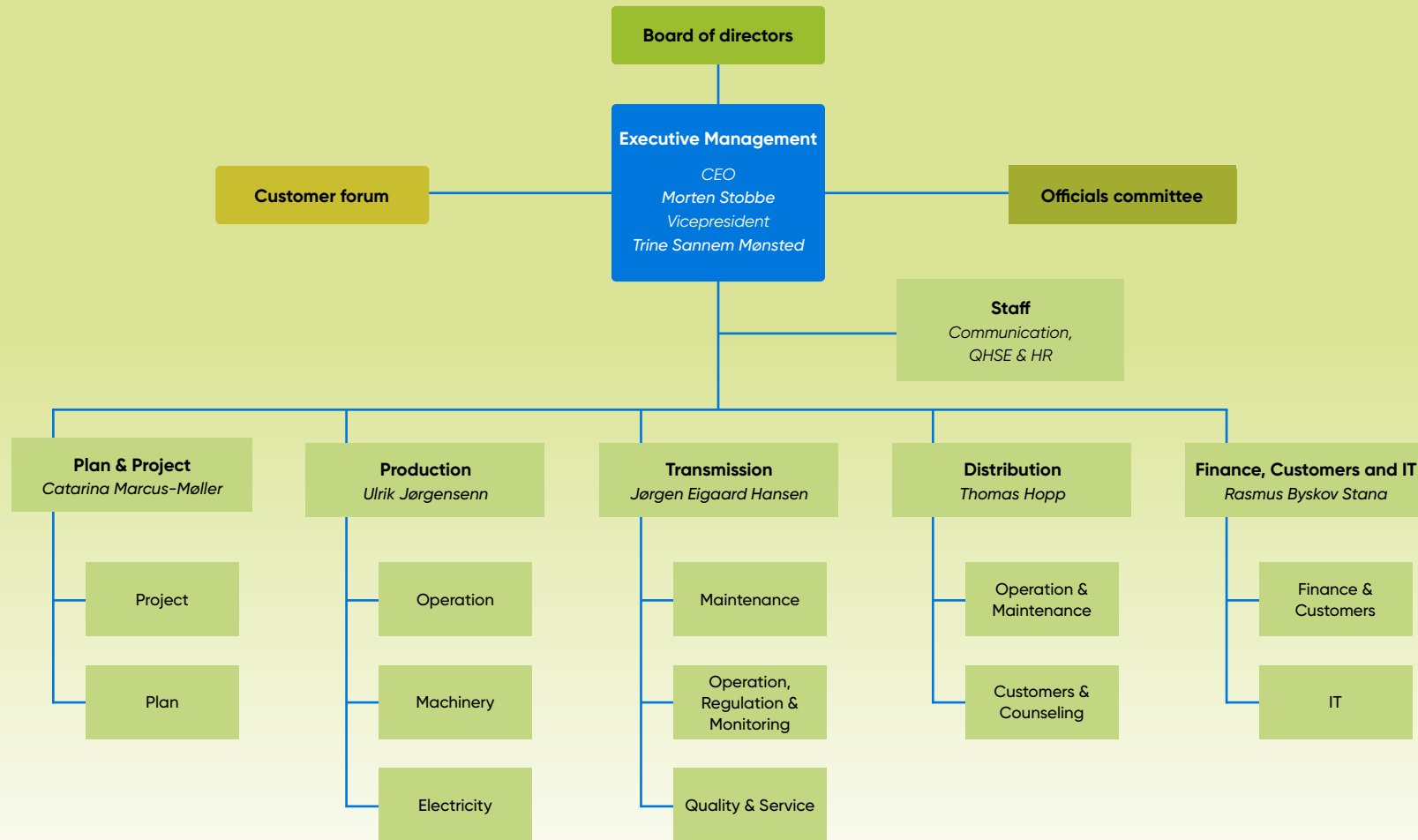
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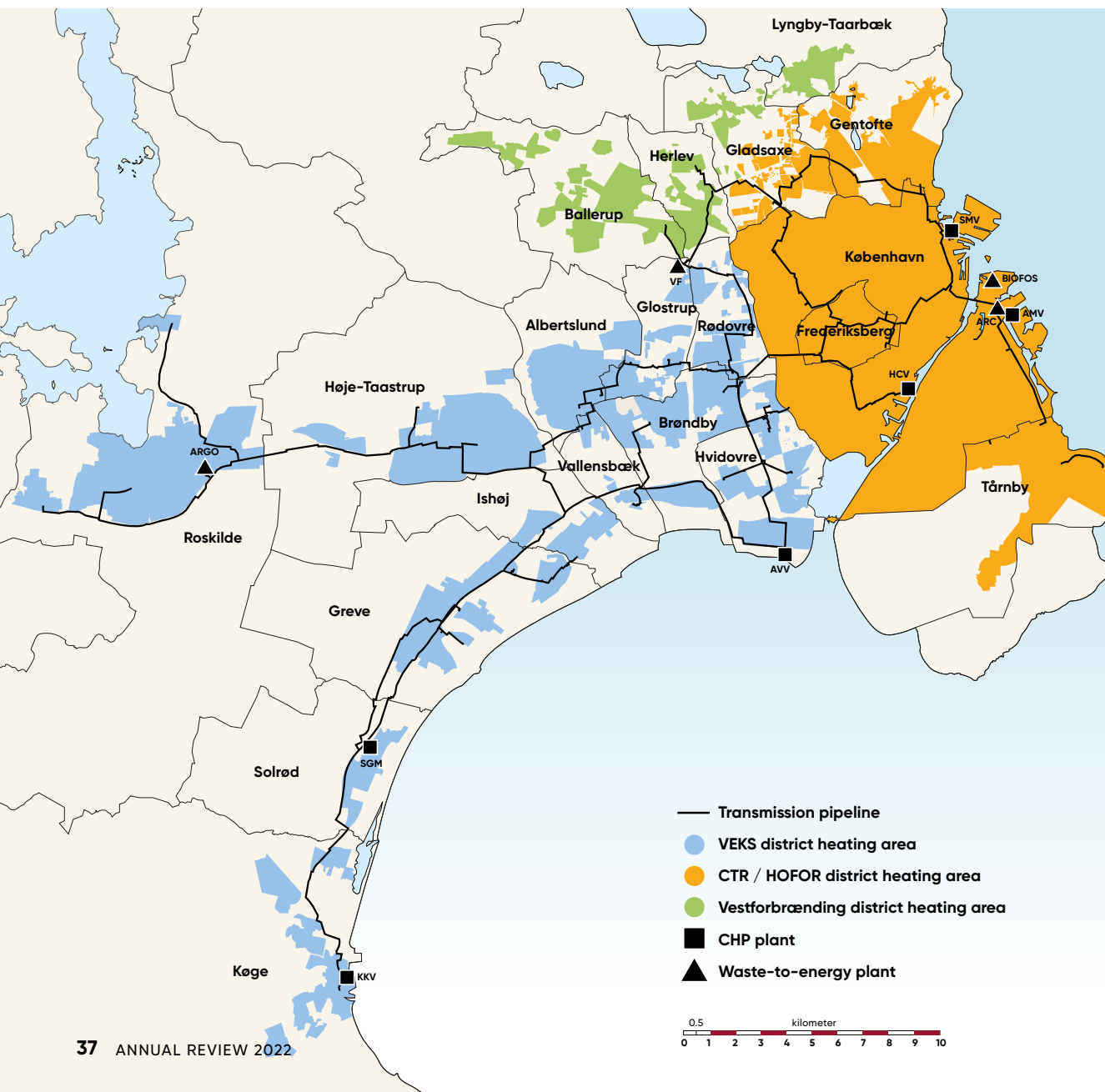
Vallensbæk Fjernvarme Syd:

Ruth Sloth Frederiksen, Niels Okstoft,
Søren Slothsberg & Helle Ullum

Executive Board and Management Group, april 2023



DH in the Copenhagen Area



Units and definitions

- TJ = Terajoule
- GJ = Gigajoule
- MWh = Megawatt hour
- 1 TJ = 1,000 GJ
- 1 MWh = 3.6 GJ
- MJ/s = Megajoule per second (heat output)
- MW = Megawatt (power output)
- 1 MJ/s = 1MW = 1,000 kW

Average energy consumed for heating and hot water amounts to approximately:

- 60 GJ/year for single-family houses (120 m²)
- 40 GJ/year for apartments in multi-storey buildings (75 m²)

Degree days

Degree days are applied in connection with the assessment of the heat required in buildings. The number of degree days per 24 hours is an indication of how cold it was and thus how much energy has been needed for space heating.

Degree days are calculated as the difference between mean outdoor temperatures and the 17 degree Celsius indoor temperature. Days during which

the temperature exceeds 17 degrees Celsius are not included. The degree days of a normal year are established on the basis of the average of degree days throughout a number of years.

In VEKS' system, the number of degree days is, for instance, 3,112 per year. Degree days and heating consumption are interlinked, i.e. the higher degree days, the higher consumption. The degree day summation for one year can be compared with the normal year. This renders it possible to assess for the year in question whether heating consumption has been high or low irrespective of the climatic conditions of the year.

Emissions

CO₂ (carbon dioxide) is a greenhouse gas released from the burning of fuels.

SO₂ (sulphur dioxide) is released from the burning of coal and oil.

NO_x (nitrogen oxide) is released when nitrogen in the air and oxygen are combined on burning of fuels.

Published by VEKS

CVR-no.: 69 33 04 28

Production: Communications Journalist
Karen Dam Mortensen

Graphics: Esben Bregninge Design

Photo: Claus Peuckert Photography

Translation: Schmidt-Kallesøe



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