

PROGRAMME



GOING OFFSHORE

CHALLENGES OF THE FUTURE POWER GRID

Aalborg, Denmark

About CIGRE

Founded in 1921, CIGRE (International Council on Large Electric Systems), is an international non-profit association for promoting collaboration with experts from around the world by sharing knowledge and experience. CIGRE's mission is 'To be the world's foremost collaborative technical reference organisation for all aspects of the electric power system'.

CIGRE counts more than 3500 experts working together in structured work programmes. Their main objectives are to design and deploy the power system for the future, optimise existing equipment and power systems, and facilitate access to information, while protecting the environment.

- 60 national committees, in more than 90 countries
- 15000 members and growing
- 1250 member organisations

The CIGRE Danish National Committee was founded in 1946. It is a great pleasure for the Committee to welcome the first CIGRE international Symposium on Danish soil.



About the Aalborg Symposium

The main theme of the symposium is GOING OFFSHORE and its main purpose is to provide a forum for recent research results and system operations experience related to the rapid transformation and challenges imposed on networks and markets by increased amounts of renewables in the energy mix. Offshore wind power is among the most promising candidates to meet the climate goals of United Nations and a strong growth is foreseen in the years to come. The changes from traditional electricity generation methods and patterns into including offshore wind power as a major source put forward technical challenges to power systems both offshore but also onshore. The objective of the symposium therefore addresses recent technical advances and policies that allow transmission and distribution networks to enter their next era, in particular those related to offshore generation, transmission and distribution.

About the Venue

Aalborg has a rich and long history, going back to the Vikings. Successful heavy industries have gradually transitioned into an environment of technology-rich enterprises, a feat not least due to the presence of Aalborg University which organises the symposium in cooperation with CIGRE Danish National Committee. Aalborg Congress & Culture Centre (AKKC) is located in the heart of Aalborg and will host all pre-meetings and technical sessions. The Welcome Reception will be held in Nordkraft. The Gala dinner takes place in MUSIKKENS HUS at the shores of the Limfjord. Last but not least, the technical tour offers a unique opportunity to visit the 400 MW ANHOLT offshore wind power plant.

CIGRE SYMPOSIUM AALBORG 2019

Going Offshore – Challenges of the Future Power Grid

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NOTICE: During the CIGRE Symposium photos/video will be taken. If you do not want to participate in the photos/video, we kindly ask you to contact the photographer.

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WELCOME

Dear Symposium Delegates and Guests,

On behalf of the CIGRE Danish National Committee it is my pleasure to welcome colleagues and delegates, sponsors and guests to Denmark. This is the first major CIGRE event to take place in Denmark and we are very proud to be your hosts in the CIGRE Aalborg 2019 international symposium.



CIGRE has its 100 year anniversary in 2021. Power systems have been undergoing a tremendous development during this century and have become among the most solid pillars supporting wealth, growth and prosperity for humans globally. Nowadays, and in the future, our society's power systems will face its largest changes and challenges ever, due to the need to facilitate the change in energy production technologies for being able to meet the UN climate goals.

Aalborg dates its roots back to the Viking age and when the Vikings were short of anything, they would go offshore to get it. Nowadays, we have to act similarly to get access to large resources of renewable energy. The symposium's main theme is "GOING OFFSHORE – challenges of the future power grid" and it harnesses the multitude of technology changes which follow the integration of very large shares of offshore wind power energy into the entire power system.

To encompass this, we have gathered half of the study committees of CIGRE led by SC C4 in a full two-day symposium with 24 technical sessions and a technical visit by ship to ANHOLT offshore wind power plant. More than 112 technical papers spanning eight study committees will be presented and eight tutorials given. Pre-meetings for Study committees and working groups are scheduled ahead of the symposium in the same location. The Danish National Committee is much honoured to welcome Torben Glar Nielsen, CTO, Energinet and Marco Kuijpers, Senior Manager Offshore Nederland, TenneT as our keynote speakers. Their joint topic is the "North Sea Wind Power Hub" project which is highly interesting and relevant for opening the discussions in the symposium.

I would like to thank former (Carlo Alberto Nucci and Pouyan Pourbeik) and present chairmen (Zia Emin) of SC C4 for leading the symposium. My thanks also go to CIGRE president Rob Stephen and CIGRE Central Office for a brilliant assistance and support in planning and conducting such an event. The members of the organising committee, the technical committee and the local organising committee including VisitAalborg have done a great job in making my job easier. Without the support from our sponsors, this symposium would not have been possible, and we owe our greatest appreciation.

Last but not least- authors and colleagues joining the symposium – you constitute the engine of the huge power system research step ahead, presented and discussed in the symposium. Without your support, even the best planned symposium would fail its main purpose – to bring forward our CIGRE community. For this, I owe you my sincere thanks.

I wish everyone an interesting and fruitful symposium and I hope you will enjoy your visit to Denmark!

Warmest regards,
Claus Leth Bak

A handwritten signature in blue ink that reads "Claus Leth Bak". The signature is fluid and cursive, with the first name "Claus" being the most prominent.

CIGRE Danish National Committee chair and CIGRE Aalborg Symposium 2019 chair

Symposium Organising Committee

**Claus Leth Bak**

Chair
Professor, Aalborg University
Chairman of CIGRE Danish National Committee

**Jørgen S. Christensen**

Technical Director, Dansk Energi
Member CIGRE Danish National Committee

**Philippe Adam**

CIGRE Secretary General

**Zia Emin**

Chair technical organising committee
Chair SC C4
Technical Director PSC

Technical Organising Committee

**Zia Emin**

Chair technical organising committee
Chair SC C4
Technical Director PSC

**Konstantin Staschus**

Chair SC C1
Chief Innovation Officer ENTSO-E

**Susana Almeida de Graaff**

Chair SC C2
International Business Development TenneT

**Henk Sanders**

Chair SC C3
Strategist in Environmental Planning TenneT

**Christine Schwaegerl**

Chair SC C6
Professor, Augsburg University

**Marco Marelli**

Chair SC B1
System Design Engineering Director Prysmian
Powerlink SRL

**Herbert Lugschitz**

Chair SC B2
Senior Asset Management Officer Austrian
Power Grid

**Mohamed Rashwan**

Chair SC B4
President Transgrid Solutions

**Filipe Faria da Silva**

Local Technical Organiser
Associate Professor, Aalborg University



Local Organising Committee

**Claus Leth Bak**

Chair
Professor, Aalborg University
Chairman of CIGRE Danish National Committee

**Filipe Faria da Silva**

Local Technical Organiser
Associate Professor, Aalborg University

**Jayakrishnan Pillai**

Local Technical Organiser
Associate Professor, Aalborg University

**Chengxi Liu**

Local Technical Organiser
Associate Professor, Aalborg University

**Qian Wang**

Local Technical Organiser
Assistant Professor, Aalborg University

**Peter Weinreich-Jensen**

Technical Support to LOC
Siemens, Member CIGRE Danish National Committee

**Hanne Munk Madsen**

Local Organiser Venue and Marketing
Aalborg University

**Anette Lundsgaard Larsen**

Local Organiser Venue and Marketing
Aalborg University

**Henriette Bugge Mortensen**

PCO Organiser
VisitAalborg



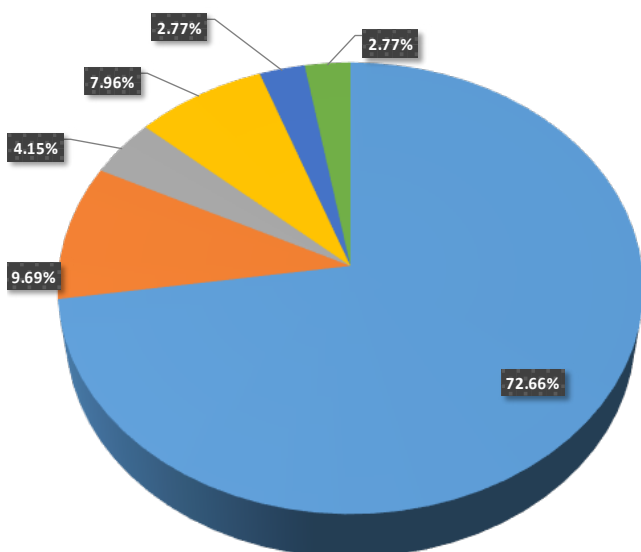
Enabling the Power of Offshore wind

As the largest supplier of electrical components, systems and services to the wind power industry, we have decades of experience and have installed more equipment in wind farms than any other supplier. www.abb.com/windpower





Participants distributions:



Symposium Facts:

- **112** submitted papers from **27** countries
- Around **300** delegates registered from **33** countries
- **30** working group meetings
- **8** study committees and **3** study committee meetings

- Europe
- North America
- South America
- Asia
- Africa
- Oceania



Paving the Way for a Cleaner Energy Future

Interview with Claus Møller, CEO Siemens A/S

Why is Siemens attending CIGRÉ Symposium 2019?

"One of the world's key challenges is how to design the future energy system based on renewables. Though you may speak of it as "the future", the energy infrastructure is being built in the present. I see the CIGRÉ Symposium as an ideal setting to learn and share experiences on how to build the necessary infrastructure. This year I'm particularly proud that we for the first time are hosting the CIGRÉ Symposium in Denmark, Aalborg. It is an excellent opportunity to share the expertise on establishing large offshore wind farms that we have built over decades in Denmark."

Where do you see the biggest technological challenge in terms of the future transmission and distribution grid?

"I believe the development of the future grids will be driven by three D's; Decarbonization, Decentraliza-

tion and Digitalization. The decarbonization of our energy system results in much more electrical energy. Consequently, more HVDC connections like the Viking Link will be needed, allowing us to balance and exchange large amounts of renewable energy between countries. At the same time, centralized power plants will eventually be replaced with a decentralized array of conversion and storage technologies – for example batteries or systems like electrolyzers which can be used to produce electro-fuels. Finally, I believe digitalization will not only provide the technical basis for this transformation, but it will also act as a catalyst by automating the new market mechanisms of flexible 'prosumers'. In my opinion, the main challenge today is to achieve a better understanding of all these technologies, their business models, and the underlying process of digitalization that makes the future grid possible."

How can offshore wind power become increasingly integrated in other parts of our modern society?

"Taking Denmark as an example, wind and solar power covered 43.5% of Denmark's electricity consumption in 2018. However, when looking at the total energy consumption it corresponds to less than 10%. Therefore, it is crucial to integrate renewables into the heating, industry and mobility sectors. Fortunately, such technologies are already in development – if not existing. In Siemens, we currently have a strong focus on three objectives: Electrifying the district heating system via heat pumps, preventing CO₂ from entering the atmosphere via carbon capture, and producing green electro-fuels for vehicles, long-distance transport or the chemical industry via Power2X conversion. If we are to become fossil free, these objectives are something the entire energy sector should pursue." ■

KEYNOTE SPEAKERS

Speech 1: North Sea Wind Power Hub

Torben Glar Nielsen

Executive Vice President, CTO and member of the board of directors in Energinet



In 1974, Torben Glar Nielsen was employed as Development Engineer at Nea-Lindberg in Ballerup, Denmark (part of FLSmidth). Towards 1989, he was Development Manager and Division Manager of Power Control Division, respectively. In 1989, Torben Glar Nielsen joined a position as Distribution Manager at the grid company SEAS in Haslev, Denmark. By the merger with NVE in 2004, Torben Glar Nielsen was Technical Director and member of the board of directors, and he held this position after the merger. Since 2007, Torben Glar Nielsen has been employed in Energinet as Executive Vice President of the Electricity Division, later as Executive Vice President, CTO and member of the board of directors.

Marco Kuijpers

Senior Manager Offshore Netherlands and Large Projects Offshore Germany at TenneT



Marco Kuijpers is responsible for the offshore projects of TenneT in the Netherlands and Germany. This includes the German 900MW DC projects connecting offshore wind energy, the eight Dutch 700MW AC grid connection systems, as well as the IJmuiden-Ver 2GW DC projects and the interconnectors COBRACable and Nordlink. Marco is within TenneT also responsible for the North Sea Wind Power Hub, the partnership between Energinet.dk, Gasunie, the Port of Rotterdam and TenneT focussing on connecting large amounts of offshore wind energy after 2030. Before entering TenneT in 2014 Marco Kuijpers was managing partner at one of the leading Dutch management consultancy firms, specialized in energy consultancy, stakeholder management, alliances and capital investments.

Speech 2: CIGRE Technical Council Chair Address

Marcio Szechtman

CIGRE Technical Council Chair, Eletrobras Chief Transmission Officer



Marcio Szechtman is the Technical Council Chair – equivalent to Vice-President Technical of CIGRE, since 2018. From 2002 to 2008, he was the CIGRE Study Committee B4 – HVDC and Power Electronics. He was the Director General of CEPEL, the Brazilian National Power Research Institute from January 2017 till April 2019. In April 2019, he was nominated as Eletrobras Chief Transmission Officer. Over his career, he worked as Advisor committed to assist Utilities, Regulators, System Operators and Investor in their technical and business activities, mainly in the area of Transmission Systems, comprising both AC and HVDC. He received the CIGRE Medal in 2014. He received the Life Fellow degree from IEEE in 2018. He also received the Uno Lamm HVDC IEEE/PES Award in 2009.

SOCIAL EVENTS

Welcome Reception

The Welcome Reception will take place in Kedelhallen, Nordkraft on Tuesday, June 4 from 18:30 to 20:30. Light meals (tapas) and various drinks are served. The Raggedy Anns will entertain with acoustic bluegrass, country and folk style music. <https://www.facebook.com/theraggedyanns>. This is a great opportunity to network with colleagues old and new.

Nordkraft, which used to be a coal-fired power plant, is the central culture house in Aalborg and includes a theatre, a music venue, a cinema, a sports center and much more. For instance, you can find Skråen – the most popular music venue in Aalborg – which presents great concerts and stand-up shows throughout the year.

Gala Dinner

The Gala Dinner will take place on Wednesday, June 5 from 18:30 to 23:00 in Øvre Foyer, Musikkens Hus. Snacks and sparkling wine are served, when the welcome presentation is given. Afterwards, delegates will enjoy the concert in the magnificent concert hall given by Piazzolla Orchestra, which plays music composed by Argentinean Astor Piazzolla. Their music style is dramatic and passionate – like a journey to Buenos Aires! The concert is followed by a three-course dinner upstairs overlooking the Limfjord and the harbour front. Delegates are asked to make their own way to/from the venue. This is a ticket only event.

Musikkens Hus is not only an architectonic lighthouse of Aalborg and Northern Jutland, but also very much a national and international rendezvous of music.

The construction of Musikkens Hus is one of the most ambitious and impressive projects in the history of Aalborg. The road to a house of music in Northern Jutland has spanned 28 years. However, natives of Northern Jutland are very persistent, so now, the house is ready to welcome all with a musical interest.



Nordkraft



Musikkens Hus

Spouses Programme

City Walk

The city walk will take place on June 5 from 10:30 to 14:00. Guests will meet the guide in AKKC at 10:30. The tour will take guests through the streets of Aalborg, where they will experience history mixed with the 21st century at close range.

They will walk through the old Aalborg with renaissance mansions, a baroque style Old Town Hall and shady dungeons, as well as a modern waterfront with a clean Scandinavian feel and not least architecture from world-renowned architects, among them Jørn Utzon, the architect behind the iconic Sydney Opera House. The tour will continue to history-rich Hjelmestald, an old, picture-perfect street located right in the heart of Aalborg. The tour ends by one of the treasures of Aalborg – Jens Bang's Stone House. In the basement, guests will dine for lunch on the Danish specialty, smørrebrød, as they cannot leave Denmark without having tried this kind of traditional lunch.

Spouses tour: Skagen - Grenen

The spouses tour to Skagen - Grenen will take place on June 6 from 09:00 to 16:30. The top of the continent, Grenen and Skagen are well worth a visit. The special light created by the sun and the location between two seas means that nature plays a major role here. Guests can experience the special light at the top of Denmark, see the paintings from the famous Skagens painters and enjoy the atmosphere on Skagens charming harbour.

Guests will take bus from Aalborg to Skagen at 09:00. Upon arrival, you either walk or ride with "Sandormen" to Grenen to see the breaking of oceans Kattegat and Skagerak. Afterwards, lunch will be served at the famous Brøndums Hotel – which hosted the Skagen painters. After lunch, you will visit Skagen Kunstmuseum, masterpieces from Danish artists P.S. Krøyer and Michael Ancher. The bus returns to Aalborg around 15:00.



Aalborg city



Skagen

GENERAL INFORMATION

Conference venue

AALBORG CONGRESS & CULTURE CENTRE (AKKC)
Europa Plads 4
9000 Aalborg
akkc@akkc.dk

Transportation

Flight

Aalborg Airport (Aalborg Lufthavn) is 10-15 minutes from the city centre by bus or taxi.

Bus

The bus fare is DKK 22 per person, cash only. Foreign currency and credit cards are not accepted. You can withdraw cash from ATMs at the airport and in the city centre.

Train

Aalborg central train station is located a few minutes from Aalborg Congress & Culture Centre by foot. Simply walk through the park Kildeparken. Trains from Aalborg connect you to the rest of Denmark.

Taxi

You can find taxis outside the airport that will take you directly to your hotel or the conference venue. Also, you can always call +45 9810 1010 (Aalborg Taxi) to request a taxi. The price for a taxi ride between the airport and the city centre is around DKK 180 – 350. Most credit cards are accepted.

Parking at AKKC

Parking is subject to payment during the following hours:

Weekdays: 08:00 – 19:00

Weekends: 08:00 – 16:00

Parking tariffs per hour: DKK 7 (Max. DKK 35 per day)

Visit <https://uk.akkc.dk/about-akkc/getting-there-and-parking/> to see more available parking spaces in Aalborg.

Charging points for electric vehicles

Electric vehicles can be recharged free of charge from the two charging points that are found at the entrance to the multi-storey car park. The sockets provide 230 Volts, up to 16A each. Charging of electric vehicles is provided free of charge by Aalborg City Council as part of the municipal authority's efforts to promote sustainable traffic. Please note that electric vehicles must pay normal parking tariffs at these charging points.

Registration desk

The CIGRE Symposium registration and information desk is situated at the entrance area.

Desk opening hours:

Tuesday, June 4	09:00 – 17:00
Wednesday, June 5	08:00 – 17:30
Thursday, June 6	08:00 – 18:00

Free WiFi at AKKC:

Network name: CIGRE2019 Password: GoingOffshore

Badges

Upon registration, you will receive a name badge. Please wear this badge at all times.

Printing

Printing is available at AKKC. Enquire at the reception and pay with credit card (American Express is NOT accepted).

Coffee, Tea and Lunch breaks

During planned breaks, tea, coffee, ice water and cut fruit will be served in Foyer II (outside the room Europahallen) and on the 1st floor (outside session rooms). Lunch will be served on the first floor in Gæstesalen and Papegøjeburet on June 5 and 6.

Cloakroom

Supervised cloakroom and baggage storage in Foyer II right outside the room Europahallen is available during the conference opening hours. It is free of charge.

Emergency

For emergencies where you need to call an ambulance, the police, or the fire department, dial 112; If you need to contact the police in a non-emergency, dial 114.

Aalborg University Hospital

Hobrovej 18 – 22
9000 Aalborg

24h-pharmacy

Over-the-counter medicines are available for purchase without a prescription at pharmacies and approved supermarkets, kiosks, drug stores and petrol stations. A doctor's or dentist's prescription is required in order to purchase prescription medicines.

Aalborg

Aalborg is a multi-faceted city – full of contrasts. A city with a lust for life and all of its pleasures. It is also grand on a manageable scale. All the major city attractions are concentrated within easy distance. From fast-paced fun to peaceful oases. From a foaming draft beer to sublime gastronomy. From the Viking Era to the Middle Ages, to modern art.

The city's recently restored waterfront has much to offer for the outdoor and curious visitor. With its many open-air sports and recreational areas, the waterfront invites both active guests and those with lust for life. Near the waterfront, you will find both the new Nordkraft and the architectural astonishing Utzon Center.

Until recently, Nordkraft supplied the people of Aalborg with electricity. But now the old, coal-fired power station in the center of Aalborg generates a completely different kind of power – Culture Power. The new eagerly awaited cultural powerhouse of Aalborg Nordkraft opened its doors in 2009. Nordkraft brings together culture, sports, and recreation, combining sports facilities, a cinema, theatres, and restaurants under one roof – all in a fusion of contemporary architecture and authentic industrial styles that create a very special atmosphere. With its unique, raw and industrial yet still stimulating look, Nordkraft truly reveals the identity of Aalborg.

Right next to Nordkraft is the Utzon Center, both situated at Aalborg waterfront. The Utzon Center was the last work of the Aalborg-born architect Jørn Utzon who also designed the world famous Opera House in Sydney. He described Utzon Center as “a place where good thoughts could come together and... a centre of excellence for architecture and humanity in the future.”

More information see the website: www.visitaalborg.com



Shopping

With its abundance of shops, Aalborg's high streets are an eldorado for anyone who loves to shop. But, whatever you do, don't miss the side streets. They are packed with exciting little shops selling the work of young designers and craftspeople. You never know what you'll find.

In Aalborg, you will find two large shopping streets – Bispensgade and Algade – with some smaller streets attached. There are three popular shopping centers: Friis, Salling and Magasin.

www.friisaalborg.dk

www.salling.dk

www.magasin.dk



Shopping hours:

Mon-Thurs: 10:00 – 17:30

Fri: 10:00 – 19:00

Sat: 10:00 – 16:00

Sun: 11:00 – 15:00

Restaurants

Aalborg offers visitors an excellent choice of restaurants.



Restaurant suggestions:

Mortens Kro

mortenskro.dk

Bühlmann

buhlmann.dk

Fusion

restaurantfusion.dk

Papegøjehaven

www.papegojehaven.dk

Duus Vinkjælder

duusvinkjaelder.dk

Prinses Juliana

www.prinsesjuliana.dk/

Tabu

ta-bu.dk

Søgaards Bryghus

soegaardsbryghus.dk

Ok Mad & Vin

www.visitaalborg.dk

Azzurra Nordkraft

azzurra.dk

PINGVIN - World Tapas

pingvintapas.dk

NOTICE: June 5 (Constitution Day) and June 10 (Pentecost Monday) are public holidays in Denmark, where most shops are closed.

Things to do in Aalborg

Aalborg Zoo

With far more than 100 different exotic animal species, educational experiences can be found all year round. You can see how the animals adapt to the different seasons and watch the baby animals grow. And you can try and find the curious and lesser known animals. In the South American house, the sloths climb freely about in the lianas above your head. This is also the place to be if you want to get close to an armadillo and perhaps see a capybara for the first time.

Kunsten - Museum of Modern Art Aalborg

Kunsten – the Museum of Modern Art in Aalborg – has reopened after a massive renovation, and once again, you can experience modern art in this architectural gem in new clothes. The building is in a league of its own internationally, and it was designed by the world famous Finnish architect Alvar Aalto in collaboration with Elissa Aalto and Jean-Jacques Barué.

Musikkens Hus

The construction of Musikkens Hus is one of the most ambitious and impressive projects in the history of Aalborg. The road to a house of music in Northern Jutland has spanned 28 years. However, natives of Northern Jutland are very persistent, so now, the house is ready to welcome all with a musical interest.

Lindholm Høje

At Lindholm Høje, archaeologists have found several burial sites and settlements originating from both the Germanic Iron Age and the Viking Age, two very important eras in Danish history.

FunCenter

Funcenter offers both outdoor and indoor entertainment activities for groups, such as laser game, paintball, and other fun games. Funcenter is located near central Aalborg and easily reached by car.

Utzon Center

The impressive Utzon Center is a vibrant cultural center located in Aalborg waterfront. The center was designed by the famous Danish architect Jørn Utzon, who was raised in Aalborg, and his son Kim Utzon.

Springeren - Marine Experience Center

At Springeren - Maritime Centre, the visitors get to experience the unique life at sea in the Port of Aalborg and Aalborg Shipyards.

Aalborg Defence and Garrison Museum

In Aalborg you have the chance to visit a complete exhibition about the Danish defence force and the period of occupation during WWII. In the museum, you will find cars, planes, motorcycles, tanks, and much more.

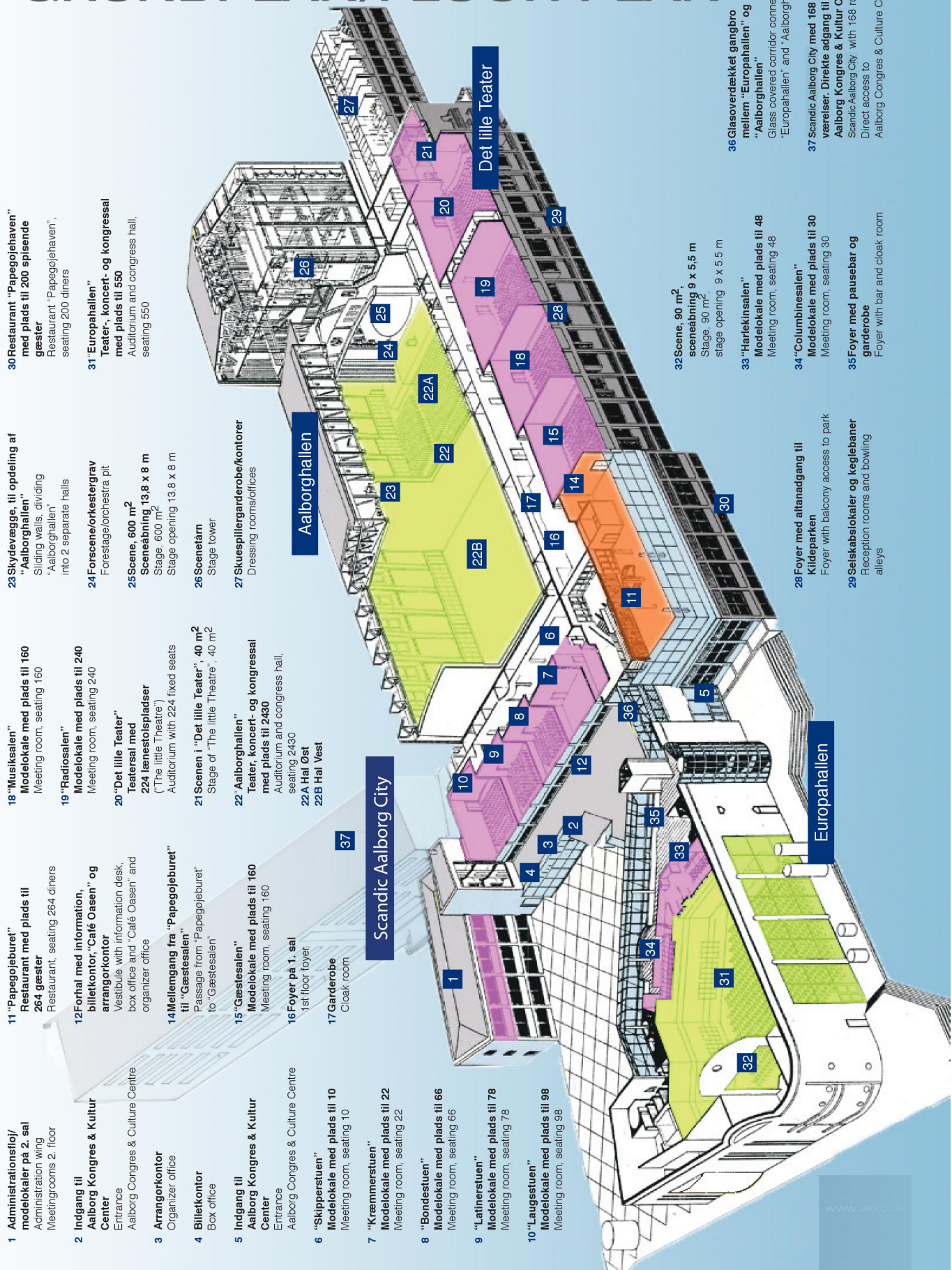
The Aalborg Historical Museum

At Aalborg Historical Museum, plenty of exciting experiences await you and your family. Bring your children along as there is plenty of fun and activities for them and a chance to explore.



- 1 Aalborg Congress & Culture Centre**
Europa Plads 4
akkc@akkc.dk, +45 9935 5555
- 2 Nordkraft**
- 3 Aalborg Bus Terminal**
- 4 Aalborg Train Station**
- 5 Tourist information, VisitAalborg**
- 6 Aalborg Airport (5 km)**
- 7 Radisson BLU Limfjord Hotel**
Ved Stranden 14-16
- 8 Scandic Aalborg City**
Europa Plads 1
- 9 Comwell Hvide Hus Aalborg**
Vesterbro 2
- 10 Hotel Gestus**
Vesterbro 36
- 11 Musikens Hus - House of Music**
- 12 Kunsten Museum of Modern Art Aalborg**
Mon: Closed, Tue: 10am - 5pm, Wed: 10am - 9pm,
Thu-Sun: 10am - 5pm
Admission: DKK 110 (adult) / DKK 60 (student)
- 13 Utzon Centre**
Mon: closed, Tue-Fri: 11am - 5pm (Thu until 9pm),
Sat-Sun: 10am - 5pm
Admission: DKK 80 (adult) / DKK 40 (student)
- 14 Gråbrødrekløster Museum
The Franciscan Monastery Museum**
Tue-Sat: 10am - 5pm
Admission by self-service via the lift tower by the department store "Salling" in Algade.
Lift down will be closed at 4:30pm. You can drive up until 5pm. Admission: DKK 40 per lift (coins only)
- 15 Aalborg Historical Museum**
Tue-Sat: 10am - 5pm
Admission: DKK 40 (adult) / DKK 30 (student)

GRUNDPLAN/FLOOR PLAN



WE FIND PATHS TO THE ENERGY OF THE FUTURE

Energinet owns, maintains and develops the Danish transmission system for electricity and gas. Further, we operate and maintain eight landing facilities and a number of offshore interconnectors.

Our job is to work for the supply of more renewable energy through our electricity and gas grids while upholding the security of supply.

We do so in close collaboration with our colleagues in the energy sector – both in Denmark and internationally.



Connecting Opportunity to Growth

Vestas, your trusted partner in the hybrid journey

Considerable opportunities are opening up for those who can take renewables to the next level.

Vestas' hybrid power plant solutions are one of the keys to unlocking new business models and revenue streams.

If you are looking to power a bright future, please check out our exciting job opportunities.

<https://careers.vestas.com>

Wind. It means the world to us.™

Vestas

About Vestas

Vestas is the energy industry's global partner on sustainable energy solutions. We design, manufacture, install, and service wind turbines across the globe, and with more than 101 GW of wind turbines in 80 countries, we have installed more wind power than anyone else.

PROGRAMME AT A GLANCE

DAY	TIME	ACTIVITY
Sunday, June 2 nd	/	Study committee and working group meetings
Monday, June 3 rd	/	Study committee and working group meetings
Tuesday, June 4 th	/	Study committee and working group meetings
	10:00 – 12:00	Panel session on the MIGRATE project
	13:00 – 16:30	Tutorials
	18:30 – 20:30	Welcome reception
Wednesday, June 5 th	08:30 – 10:00	Opening session – Introduction and Welcome Keynote speech – “North Sea Wind Power Hub” CIGRE technical council chair address
	10:30 – 11:00	Lead sponsors address by Siemens and Ørsted
	11:00 – 12:30	Sessions 1/2/3
	12:30 – 13:30	Lunch
	13:30 – 15:00	Sessions 4/5/6
	15:30 – 17:00	Sessions 7/8/9
	18:30	Gala dinner
Thursday, June 6 th	08:00 – 09:30	Sessions 10/11/12
	09:45 – 11:00	Sessions 13/14/15
	11:15 – 12:30	Sessions 16/17/18
	12:30 – 13:15	Lunch
	13:15 – 14:45	Sessions 19/20/21
	15:15 – 17:00	Sessions 22/23/24
	13:15 – 17:00	Young Member (YM) poster session
	17:15 – 18:00	Closing session
Friday, June 7 th	09:00 – 18:00	Technical tour to offshore wind power plant ANHOLT with the Anholt ferry including lectures and lunch

FULL PROGRAMME

Tuesday 4th June 2019

09:00 – 17:00 Registration Open

10:00 – 12:00
(In Det lille teater) Panel session on the MIGRATE project

13:00 – 14:30

Tutorial (SC B1), room Gæstesalen
Offshore generation cable connections

Tutorial (SC B2), room Musiksalen
Guide to the conversion of existing AC lines to DC operation

Tutorial (SC C3), room Radiosalen
Line Routing in Urban and Rural Areas

Tutorial (SC C4), room Det lille teater
Network Modelling for Harmonic Studies

14:30 – 15:00 Coffee Break

15:00 – 16:30

Tutorial (SC B4), room Gæstesalen
Control and Protection of HVDC Grids

Tutorial (SC C1), room Musiksalen
The future of reliability – Definition of reliability in light of new developments in various devices and services which offer customers and system operators new levels of flexibility

Tutorial (SC C2), room Radiosalen
Wide Area Monitoring – Control Room Applications

Tutorial (SC C6), room Det lille teater
Control and Automation Systems for Electricity Distribution Networks of the Future (emphasizing the TSO/DSO interface)

18:30 – 20:30 **Welcome Reception in Nordkraft**

Welcome speech by Claus Leth Bak, Chair of Symposium

Welcome speech by Kristoffer Hjort Storm, Vice Mayor of Aalborg City

‘Transformation of NORDKRAFT - coal-fired power plant into culture house’
by Claus René Pedersen, Aalborg Kommune

‘Denmark and CIGRE with a perspective on future energy supply and offshore wind power’ by Jørgen S. Christensen, CIGRE Danish National committee and CTO Dansk Energi

‘An independent developer perspective on the future offshore transmission networks’ by Zac Richardson, Head of Business Development, National Grid

FULL PROGRAMME

Wednesday 5th June 2019

08:00 – 17:30	Registration Open
	Opening Session
08:30 – 10:00 (In Europahallen)	Introduction and Welcome
	Keynote speech – “North Sea Wind Power Hub”
	CIGRE technical council chair address
10:00 – 10:30	Coffee Break
10:30 – 11:00 (In Europahallen)	Lead sponsors' address by Siemens and Ørsted
	Session 1: Electromagnetic transient aspects (C4)
11:00 – 12:30	Session 2: Assessment and study tools for system operation (C2)
	Session 3: DC grids and multi-terminal DC systems (B4)
12:30 – 13:30	Lunch
	Session 4: System planning including offshore networks (C1)
13:30 – 15:00	Session 5: Operation of hybrid and low inertia power systems (C2)
	Session 6: Innovative solutions in FACTS and HVDC technology (B4)
15:00 – 15:30	Coffee Break
	Session 7: Power quality challenges (C4)
15:30 – 17:00	Session 8: Eco-design and environmental concerns, the social aspects (people) (C3)
	Session 9: Control and protection of DC grids (B4)
18:30 – 23:00	Gala Dinner in Musikkens Hus
18:30 – 19:00	Delegates and guests arriving to Musikkens Hus for networking and chats among colleagues.
19:00 – 19:25	Welcome in the Foyer with a presentation of the evening's programme, snacks and a glass of sparkling wine. Peter Weinreich Jensen, member Danish NC presents the program for the evening.
19:25	Concert by the Piazzolla Orchestra
20:00	Three-course dinner in the Upper Foyer

FULL PROGRAMME

Thursday 6th June 2019

08:00 – 18:00	Registration Open
	Session 10: SSR, control interactions and instabilities (C4)
08:00 – 09:30	Session 11: Support from VSC HVDC for System Operation (C2)
	Session 12: Offshore wind connection planning (C1)
09:30 – 09:45	Coffee Break
	Session 13: Cable monitoring (B1)
09:45 – 11:00	Session 14: Frequency support from power electronics interfaced devices (C2)
	Session 15: Long-term and sector-coupled decarbonized energy system planning (C1)
11:00 – 11:15	Coffee Break
	Session 16: Cable system design (B1)
11:15 – 12:30	Session 17: OHL tower design, optimization of costs, public acceptance, EMF, AC/DC coupling effects (B2)
	Session 18: Challenges for DSOs and improved TSO-DSO interoperability (C6)
12:30 – 13:15	Lunch
	Session 19: System technical aspects of wind generation (C4)
13:15 – 14:45	Session 20: Innovative strategies for active distribution network operation (C6)
	Session 21: Offshore system integration (B4)
14:45 – 15:15	Coffee Break
	Session 22: Offshore network of the future: wind farms and HVDC grid (B1)
15:15 – 17:00	Session 23: Eco-design and environmental concerns, the environmental aspects (planet) (C3)
	Session 24: Analysis and modelling of DC and FACTS (B4)
13:15 – 17:00 (In the hallway, 1 st floor)	YM Poster Session
17:15 – 18:00	Closing session: Key Symposium learnings, best YM paper award and closing remarks

FULL PROGRAMME

Friday 7th June 2019

Technical tour to offshore wind power plant ANHOLT

09:15	Bus departure from AKKC to Grenå Harbour
11:30	Ferry departure to Anholt offshore wind power plant. Troels Stybe Sørensen, member Danish NC presents the program for the technical tour.
11:35 – 12:15 (In Cafeteria)	Ørsted: 'Anholt Offshore Wind farm – Construction & Operation', Jan Holst Møller, Head of Anholt Operations
11:35 – 12:15 (In Salon)	Siemens WP/Gamesa: 'The wind turbines in Anholt offshore wind power plant', Peter J. H. Esmann, senior product manager from Siemens Gamesa Renewable Energy A/S
12:15 – 12:45 (In Cafeteria & Salon)	Lunch
12:45-13:30 (On the deck)	Cruising inside wind farm with guests on sun-deck enjoying the weather and observing the wind farm. Jan Holst Møller will comment via the Ferry public announcement system
13:30 – 14:25 (In Cafeteria)	Energinet: 'Transmission network connection – technical challenges', Jun Bum Kwon, Grid Analyst, Energinet
13:30 – 13:55 (In Salon)	Vestas/MHI: 'Offshore wind power – a perspective from Vestas/MHI', Tusitha Abeyasekera
14:00 – 14:25 (In Salon)	ABB: 'Harmonic Resonance and Converter Interoperability in Offshore Wind Farms', Dr. Mats Larsson, Senior Principal Scientist at Corporate Research, ABB Switzerland Ltd
14:30	Ferry returning to Grenå Harbour
16:00 – 18:00	Bus returning to AKKC

*Breaks and discussion time will be given during the programme;

** The time slots are approximated, and they may subject to change due to bus and ferry traffic.

WEDNESDAY 5th June, 11:00 – 12:30

Paper No.		Session 1 (C4): room Europahallen Electromagnetic transient aspects	Chair: David Jacobson
011	Influence of shunt compensated EHV transmission lines consisting of several overhead line and XLPE cable sections on system performance M. Kizilcay, M. Lösing, S. Papenheim, P. Malicki, K. Vennemann		
012	Current zero-missing phenomenon analysis for transformer tertiary connected shunt reactors F. Koehler, D. Allan, M. Stockton		
141	Assessment of temporary overvoltages - metal-oxide surge arresters and power apparatus - A study case for a 1400 MW offshore grid in the netherlands K. Velitsikakis, C.S. Engelbrecht, I. Tannemaat		
161	Electromagnetic transient (EMT) studies of kriegers flak combined grid solution system J. B. Kwon, D. M. Perez, C. S. Hansen, C. F. Flytkjær		
116	Induced voltages limits for utilities in a common power line corridor H. Negi, A. Leith, S. Mcmillan		
		Session 2 (C2): room Radiosalen Assessment and study tools for system operation	Chair: Todd Ramey
049	Inertia estimation methodologies vs measurement methodology: impact on system operations B. Berry		
051	A hybrid simulation platform for power system restoration R. Mushimiye, C. Liu, C. L. Bak		
078	Full line decomposition method for power flow analysis and congestion management J. Van Casteren, B. Cijssouw, S. A. Graaff, D. Klaar		
091	Applicational concept for a dynamic power system mirror in the control room C. Brosinsky, T. Sennewald, R. Krebs, D. Westermann		
126	System identification techniques for validating hydro power plant's FCR performance S.H. Jakobsen, K. Uhlen, P. Lie		
		Session 3 (B4): room Det lille teater DC grids and multi-terminal dc systems	Chair: Ting An
045	HVDC grid protection algorithm performance assessment W. Leterme, M. Wang, G. Chaffey, D. Van Hertem		
083 (YM)	An impedance-based SVD robust supplementary controller design for offshore HV-MTDC grids A. J. Agbemuko, J. L. D. García, O. G. Bellmunt		
093 (YM)	Post-fault voltage recovery for multi-terminal HVDC networks based on fault blocking converters P. Ruffing, C. Brantl, R. Puffer		
077	Experimental results on interoperability in multi-vendor HVDC systems from Best Paths DEMO2 project O. Despouys, P. Rault, C. Wikstrom, A. Burgos, J. Rimez, D. Vozikis, X. Guillaud		
105	Preparing the expansion of a point-to-point VSC link into a multi-terminal HVDC transmission system: a COBRACable research project R. Irnawan, A. Perilla, F. F. Silva, C. L. Bak, J. L. R. Torres, M. Meijden, N. Qin, A. M. Lindefelt, A. Alefrakis		

WEDNESDAY 5th June, 13:30 – 15:00

Session 4 (C1): room Musiksalen Chair: Konstantin Staschus System planning incl. Offshore networks	
068	Optimal placement of phase shifting transformers based on MADM method: the considering system performance indices R. Rezvanfar, H. Ghasemi, M. E. Mosayebian, M. Ghomi, F. F. Silva, C. L. Bak
072	The development of offshore wind farms in France B. Meyer, G.W. De Saint-Martin
146	International survey on adoption of resilience within the electricity sector CIGRE C4.47 Working Group on Power System Resilience
102 (YM)	A methodology for societal cost-benefit analysis of meshed offshore grids C. Wouters, W. Van Der Veen, P. Henneaux, M.J. Van Blijswijk
162	Impact of high impact low frequency (HILF) event on Indian power system C. Kumar, A. K. Basak, S. K. Sahay, S. Banerjee
Session 5 (C2): room Radiosalen Chair: Enrico Carlini Operation of hybrid and low inertia power systems	
002	Implementation, verification and application examples of a mathematical optimization for grid operation in mixed AC/DC-systems D. Mende, D. S. Stock, L. Hofmann
047	Preventive and corrective system operation of hybrid AC-HVDC-systems T. Sennewald, F. Linke, F. Sass, D. Westermann
060	Coordinated voltage control schemes using discrete components in transmission systems with high wind power penetration and HVDC interconnectors K. D. Lund, V. Akhmatov, N. Qin, M. Powalko, L. Dall
120	System frequency variations and the effect of wind power: analysis based on an Irish transmission system test model S. Hellmuth, M. Kuschke, K. Strunz, M. Val Escudero
122	Challenges with new renewable energies integrated to a hydroelectric-based system under a large disturbance event - the Brazilian northeast case J. J. A. L. Leitao, R. L. A. Reis, M. M. S. Lira, D. O. C. BRASIL, P. F. Ribeiro
Session 6 (B4): room Det lille teater Chair: Mohamed Rashwan Innovative solutions in FACTS and HVDC technology	
019 (YM)	Research on a control strategy for STATCOM based on 3rd harmonic injection X. Wei, Z. Li
061	Control & protection strategies of STATCOM and its dynamic performance study P. Sali, K. S. K Patro, M. Karikalan
073 (YM)	Impact of the HVDC system configuration on DC line protection C. Brantl, P. Ruffing, P. Tünnerhoff, R. Puffer
097	Investigation of midpoint STATCOM effects on synchronous generator loss of field protection A. Hasani, F. Haghjoo, C. L. Bak, F. F. Silva
136	Modified half bridge submodule topology with DC fault current suppression capability M. Mohaddes

WEDNESDAY 5th June, 15:30 – 17:00

Session 7 (C4): room Det lille teater Chair: Dalton Brasil	
Power quality challenges	
008	Impacts of underground cables on power system harmonics – A real case study using simulations and field measurements I. Rahimi, C. Wang, A. Nassif, R. Cui, L. Jiao
044	Probabilistic calculation of harmonic voltages in transmission grids with varying shares of underground cables A. Neufeld, N. Schäkel, L. Hofmann, M. Lösing
065	Calculation method selection for harmonic voltage distortion gains D.H. Mills, Z. Emin, D. O'Brien, M. Val Escudero, C. F. Jensen
066	Challenges of harmonic distortion limit allocation to multiple customers in a meshed network using IEC TR 61000-3-6 D.H. Mills, Z. Emin, D. O'Brien, M. Val Escudero
046	Overcoming the challenges in small isolated power systems caused by AC arc furnaces M. Rukhvadze, A. Kokhtashvili, I. Darchiashvili, G. Arziani
Session 8 (C3): room Musiksalen Chair: Henk Sanders	
Eco-design and environmental concerns, the social aspect (people)	
003	Experience of creating a COBRACable safety culture 'better together' a cooperation of employer, contractors and subcontractors, making a next step on safety culture ladder during the construction phase of the COBRACable interconnector 2015 – 2019 W. H. M. Rozendal, J. Lunt
028	T-pylon – optimized new design from concept to installation H. Skouboe, M. Mikkelsen
056	Recommended practices for offshore wind substations, safety perspective H. Ma, L. Schmidt, P. Surrow
137	Environmental requirements for new electrical installations in Argentina C. Wall, P. Arnera, B. Barbieri
153	Improving public participation of new transmission line projects with AR/VR on mobile devices S. Grassi
Session 9 (B4): room Radiosalen Chair: Kees Koreman	
Control and protection of DC grids	
004 (YM)	Impacts of mixed usage of cables and overhead lines on selective fault detection methods in multi-terminal HVDC systems P. Tünnerhoff, C. Brantl, R. Puffer
033	Pre-standardisation of interfaces between DC circuit breaker and intelligent electronic device M. Wang, D. Jovcic, W. Leterme, D. Van Hertem, M. Zaja, I. Jahn
035	The key equipment R&D and tests of ± 535 KV hybrid HVDC circuit breaker for multi-terminal VSC-HVDC project B. Yang, Ch. Zhan, Y. Xie, W. Lv, W. Shi, W. Wang, Y. Xu
036	Test system for non-isolated MMC DC-DC converter in HVDC grids D.Jovcic, P. Dworakowski, G. Kish, A. Jamshidifar, A. Nami, A. Darbandi, X. Guillaud
063	On dynamic performance analysis for MMC-HVDC systems during AC faults S. Beckler, H. Saad, P. Rault

THURSDAY 6th June, 08:00 – 09:30

Paper No. Session 10 (C4): room Det lille teater Chair: Babak Badrzadeh SSR, control interactions and instabilities

- 014 Subsynchronous resonance mitigation using offshore wind farms
E. Ogumuno, S.O. Faried
- 026 Proven sub-synchronous control interaction prediction/protection technique for wind farms connected to AC series compensated lines
S. K. M. Kodsí, A. Sodhi
- 087 On resonance instabilities in VSCs connected to weak grids
L. Orellana, M. Cheah-Mane, E. Prieto-Araujo, L. Sainz, O. Gomis-Bellmut
- 110 Grid converter stability aspects in offshore wind power plants
M. K. Bakhshizadeh, L. Kocewiak, J. Hjerrild, F. Blaabjerg, C. L. Bak
- 127 A stability criterion for MMC-HVDC systems with subsynchronous torsional oscillations
S. Al-Areqi, P. Correa, M. Dommaschk, J. Rittiger, S. Teeuwsen, A. Chaudhry

Session 11 (C2): room Radiosalen Chair: Francois Boulet Support from VSC HVDC for system operation

- 015 Power oscillation damping using expandable VSC-HVDC transmission system
I. Mexis, R. Irnawan, F. F. Silva, H. Heo
- 129 Influence of VSC-HVDC systems on grid restoration under blackout conditions
M. Dommaschk, S. Al-Areqi, F. Schettler, A. Chaudhry, S. Schwaiger
- 139 Coordinating voltage, inertia, frequency and power oscillation damping support of a VSC HVDC connected to a weak grid
M. S. Annakkage, C. Karawita, H. Suriyaarachchi, U. D. Annakkage
- 140 A live black start test of a HVAC network using soft start capability of a voltage source HVDC converter
T. B. Sørensen, J. B. Kwon, J. M. Jørgensen, G. Bansal, P. Lundberg
- 104 Hardware-in-the-loop tests on reverse power and over-frequency protection for synchronous condensers
J. Jia, G. Yang, A. H. Nielsen, P. R. Hansen

Session 12 (C1): room Musiksalen Chair: Cornelis Plet Offshore wind connection planning

- 021 (YM) Improved method for calculating power-transfer capability curves of offshore wind farms cables
J.A. PÉREZ-RÚA, K. Das, N. A. Cutululis
- 084 (YM) The impact of offshore transmission regulatory regimes on technology choices
H. Bains, A. Madariaga, B. Kazemtabrizi, M. C. M. Troffaes
- 109 Chosen aspects of offshore wind farms connection analyses Polish case
M. Przygodzki, P. Kubek, P. Rzepka, M. Szablicki, W. Lubicki
- 142 Techno-economic feasibility of a STATCOM with battery energy storage for the offshore wind power plants
S. K. Chaudhary, X. Wang, D. Yang, R. Teodorescu, L. Kocewiak, M. P. Sidoroff Gryning, P. Johnson, et al.
- 081 (YM) Dynamic thermoelectric modelling of oil-filled power transformers for optimization of offshore windfarm export systems
S. H. H. Kazmi, J. Holbøll, T. H. Olesen, T. S. Sørensen

THURSDAY 6th June, 09:45 – 11:00

Paper No. Session 13 (B1): room Musiksalen Chair: Per Christensen Cable monitoring

- 005 A novel online fault localization technique for HVDC cable transmission systems
M. Ashouri, C. L. Bak, F. F. Silva
- 009 Combining distributed temperature sensing and dynamic cable rating as an efficient means of managing submarine cable load
E. Rochat, S. Chin
- 016 Novel distance protection algorithm for long transmission line
K. Ma, Z. Chen, C. L. Bak, M. N. Ashkzari
- 112 Submarine cable temperature monitoring experiences
C. Freitag, A. Wagner

Session 14 (C2): room Radiosalen Chair: Greg Hesse Frequency support from power electronics interfaced devices

- 013 Droop-based frequency support from offshore HVDC grids
(YM) A. Bidadfar, O. S. Romano, M. Altin, N. A. Cutululis, E.P. Araujo, O. G. Bellmund, P. E. Sørensen
- 042 Fast frequency response from offshore wind farms connected to HVDC via diode rectifiers
(YM) O. S. Romano, A. Bidadfar, J. N. Sakamuri, Ö. Göksu, N. A. Cutululis
- 070 Frequency control in a grid with high levels of inverter based generation
J. Matevosyan, R. Quint, N. Modi, M. Rampokanyo, D. Corcoran
- 076 FFR from offshore wind farms connected through HVDC links – control philosophies and challenges
(YM) P. Dattaray, D. Chakravorty, J. Bos, C. Mishra, M. Rampokanyo, A. Atallah

Session 15 (C1): room Det lille teater Chair: Keith Bell Long-term and sector-coupled decarbonized energy system

- 025 Flexibility to support the future power systems
E. Hillberg, A. Zegers, G. Migliavacca, G. Beccuti, S. Lehnhoff, K. Uhlen, I. Oleinikova, J. Pompee, et al.
- 034 Exploitation of power-to-gas for ancillary services provision in the Netherlands
B.W. Tuinema, P. K. S. Ayivor, V. García Suárez, M. E. Adabi, L. Liu, J. L. Rueda Torres, P. Palensky, et al.
- 143 Design considerations for the electrical infrastructure of the north sea wind power hub
A. Alefragkis, K. Koreman, F. Kryezi, T. Lebioda, C. Rathke
- 147 The Global electricity network – Contribution of the offshore interconnections
CIGRE C1.35 members

THURSDAY 6th June, 11:15 – 12:30

Paper No.	Session 16 (B1): room Musiksalen Cable system design	Chair: Danijela Palmgren
052	Dielectric fluids in HVAC and HVDC submarine cables for transmission of electricity K. Baburao, R. Sathiesh Kumar, R. Vasanthi	
113	Experimental measurement of electrical characteristics of HV AC cables M. Paolo	
117	Ground current calculation considerations for power network consisting overhead lines and underground cables H. Negi, A. Leith, S. Mcmillan	
134	Overvoltages in symmetric monopolar HVDC cable systems – a parameter study approach M. Saltzer, M. Goertz, S. Wenig, W. Leterme, V. Joubert, H. Saad, A. Crippa, C. Bartsch, et al.	
	Session 17 (B2): room Radiosalen OHL tower design, optimization of costs, public acceptance, EMF, AC/DC coupling effects	Chair: Herbert Lugschitz
029	New pylon design streamlines O&M procedures H. Skouboe, M. Mikkelsen	
054	Optimisation of OHL with respect to costs and public acceptance K. E. Steenholt-Eliasson, H. Skouboe, M. G. Nielsen	
062	Theoretical and experimental investigation on electrical design of a fully composite pylon Q. Wang, T. Jahangiri, C. L. Bak, F. F. Silva, H. Skouboe	
067	Investigation of EMF and ACDC coupling effect associated with full-bridge VSC HVDC systems J. Hu, B. Bisewski	
	Session 18 (C6): room Det lille teater Challenges for DSOs and improved TSO-DSO interoperability	Chair: Christine Schwaegerl
064	Advanced TSO-DSO interface for provision of ancillary services by DER in distribution networks N. Karthikeyan, B. R. Pokhrel, J. R. Pillai, B. Bak-Jensen, A. Jensen, J. Andreasen, et al.	
107	Improved TSO - DSO interoperability and their cooperation in smart grid B. R. Pokhrel, K. Nainar, B. Bak-Jensen, J. R. Pillai, A. Jensen, J. Andreasen, T. Helth, et al.	
124	Key challenges and future role of distribution network C. D'Adamo, F. Cazzato, M. Di Clerico, S. Ferrero	
156	Stability analysis of distribution feeders with high wind penetration and battery energy storage systems H. Bitaraf, S. Zabihi, R. Roys, J. Glassmire, B. Buchholz	

THURSDAY 6th June, 13:15 – 14:45

Paper No.		Session 19 (C4): room Det lille teater Chair: Andrew Halley System technical aspects of wind generation
048 (YM)	Impact of power fluctuations in reactive power capability of wind power plants M. Sarkar, M. J. Koivisto, M. Altin, P. E. Sørensen	
094	Unintended synchronisation study of the Nordic and continental European transmission system via the HVAC/HVDC interconnector of the kriegers flak combined grid solution V. Akhmatov, T. B. Sørensen, C. F. Flytkjær, A. K. Marten, R. Stornowski	
155	Hornsea projects 1 and 2 - design & execution of the grid connection for the world largest offshore wind farms J. Hjerrild, S. Sahukari, M. Juamperez, Ł. H. Kocewiak, M. A. Vilhelmsen, J. Okholm, M. Zouraraki, T. Kvarts	
157	Active filtering from wind turbines based on doubly-fed induction generator F. K. A. Lima, E. E. C. Morais, J. M. L. Fonseca, L. A. Machado, C. G. C. Branco	
041 (YM)	An incremental state space modelling method of power systems based on measured components impedance matrices in local dq frames W.H. Zhou, Y.B. Wang, Z. Chen	
		Session 20 (C6): room Musiksalen Chair: Jayakrishnan Pillai Innovative strategies for active distribution network operation
088 (YM)	Introduction to the energy mixture in an isolated grid with 100% renewable electricity – the faroe islands H.M. Tróndheim, B.A. Niclasen, T. Nielsen, C. L. Bak, F. F. Silva	
103 (YM)	Real-time reconfiguration strategy of self-adequate distribution network based on deep reinforcement learning S. Oh, S. Kim, Y. Yoon	
132	Optimal operation of wind-combined heat and power based electrical energy systems considering flexible ramping requirements using information gap decision theory M. Nazari-Heris, M. A. Mirzaei, A. Anvari-Moghaddam, B. Mohammadi-Ivatloo, M. Marzband	
130	Optimal energy trading strategies for proactive DISCO considering demand response programs in the distribution networks M. Daneshvar, B. Mohammadi-Ivatloo, A. Anvari-Moghaddam	
		Session 21 (B4): room Radiosalen Chair: Joanne Hu Offshore system integration
007	Integration of offshore wind by VSC based HVDC – challenges and opportunities P. Sandeberg	
040	Study cases for parallel operation of 2 VSC-HVDC schemes feeding a large islanded offshore oil and gas grid N. Krajisnik, S. Achenbach, K. Sharifabadi	
089	Medium voltage DC, grid connecting for renewable energy A. Rentschler, M. Delzenne, M. Foehr, G. Kuhn, O. Kuhn	
164	Development of hybrid HVDC concept for ultra high voltage DC system interconnection S. Auddy, P. Barupati, M. Mohammadi, Y. J. Häfner	
165	Maritime link - the first bipolar VSC HVDC enabling integration of renewable energy and stabilization of electricity grid connection Y. J. Häfner, F. Johansson, O. Vestergaard, P. Lundberg	

THURSDAY 6th June, 15:15 – 17:00

Paper No.		Session 22 (B1): room Musiksalen Chair: Roland Zhang Offshore network of the future: wind farms and HVDC grid
039	Insulation coordination for DC cable grids: expected challenges of network development from point-to-point links to HVDC grids T. Karmokar, B. Nilsson, C. Plet	
053	Installation engineering of the export cable for the Kriegers Flak offshore wind farm connection K. Cronholm, O. Gustafsson, K. Johannesson, M. Johansen, K. B. Olesen, R. A. Olsen	
115	Technical consideration for best construction of AC HV cables M. Paolo, C. Luigi	
119 (YM)	DC cable systems aspects for future offshore windfarms cost reduction D. Pietribiasi, E. Berczi	
128	Importance of mechanical design and testing of cable systems for floating offshore wind A. Tyrberg, E. Eriksson, A. Persberg	
133	Design and operation of three-core submarine cables with integrated optical fibres L. Colla, K. L. Abken	
		Session 23 (C3): room Radiosalen Chair: Henk Sanders Eco-design and environmental concerns, the environmental aspects (planet)
022	Nature inclusive design opportunities for the Dutch offshore grid S.A. Jaarsma	
023 (YM)	Bird collisions with power lines: a method to identify sensitive species and geographic areas to help onshore grid route planning F. Moreira, M. D'Amico, R.C. Martins, M. Porto, J.M. Álvarez-Martinez, R. Barrientos	
092	A landscape enhancement approach to reducing the landscape and visual impact of existing high voltage transmission lines J. F. Turner	
095	Use of passive acoustic monitoring to track marine mammals at offshore windfarm sites T. Palagyi, A. N. Rice, K. Palmquist	
121	Grid connection strategies for future commercial floating and fixed bottom wind farms in France G.Wæraas De Saint-Martin, A. Debetencourt	
125	Exploring submarine power cables from offshore wind farms environmental impacts L. K. M. Garnier, D. Saffroy, L. Chauvaud, A. Carlier, B. Taormina, M. Lejart, A. Jolivet, S. Chauvaud	
		Session 24 (B4): room Det lille teater Chair: Chandana Karawita Analysis and modelling of DC and FACTS
108	Test-bench setup for AC-side-grid-interaction analysis of MMC-based HVDC systems C. Heising, R. Bartelt, D. Meyer, T. Stötzl, V. Staudt	
018	Large signal stability assessment of the voltage source converter connected to the weak grid B. Shakerighadi, E. Ebrahimzadeh, C. L. Bak, F. Blaabjerg	
020	Analysis on grounding electrode circulating current in NBGS overcurrent test for HVDC transmission based on RTDS simulation system G. Fu, L. Li	
037	Requirements and quality assurance of HVDC digital models for power system analysis J. Glasdam, N. Qin, V. Akhmatov	
043	1200V, 200A Laboratory prototype for LC DC circuit breaker D. Jovcic	

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CIGRÉ Symposium Aalborg, Denmark

4th-7th June 2019

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