



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

# Strategic Energy Planning in countries and cities

David Drysdale (Aalborg University)

Brian Vad Mathiesen (Aalborg University)

Simon Sørensen (PlanEnergi)



# Overview of today's webinar



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- Introduction to the SmartEnCity Project
- Who is the Sustainable Energy Group at Aalborg University?
- Why do we need Strategic Energy Planning?
- What is Strategic Energy Planning?
- Summary
- Next webinars



# Overview of today's webinar



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- **Introduction to the SmartEnCity Project**
- Who is the Sustainable Energy Group at Aalborg University?
- Why do we need Strategic Energy Planning?
- What is Strategic Energy Planning?
- Summary
- Next webinars



# SmartEnCity



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- Project funded under the **European Union's Horizon 2020** research and innovation programme
- Under the coordination of Fundación TECNALIA Research & Innovation, 35 partners from 6 countries
- To develop **strategies that can be replicated** throughout Europe in order to reduce energy demand and maximise renewable energy supply
- To develop a **systemic approach for transforming European cities** into sustainable, smart and resource-efficient urban environments in Europe
- **SmartEnCity Network** is being developed for European cities



AALBORG UNIVERSITY  
DENMARK

# The purpose of these webinars



BRIAN VAD  
MATHIESEN



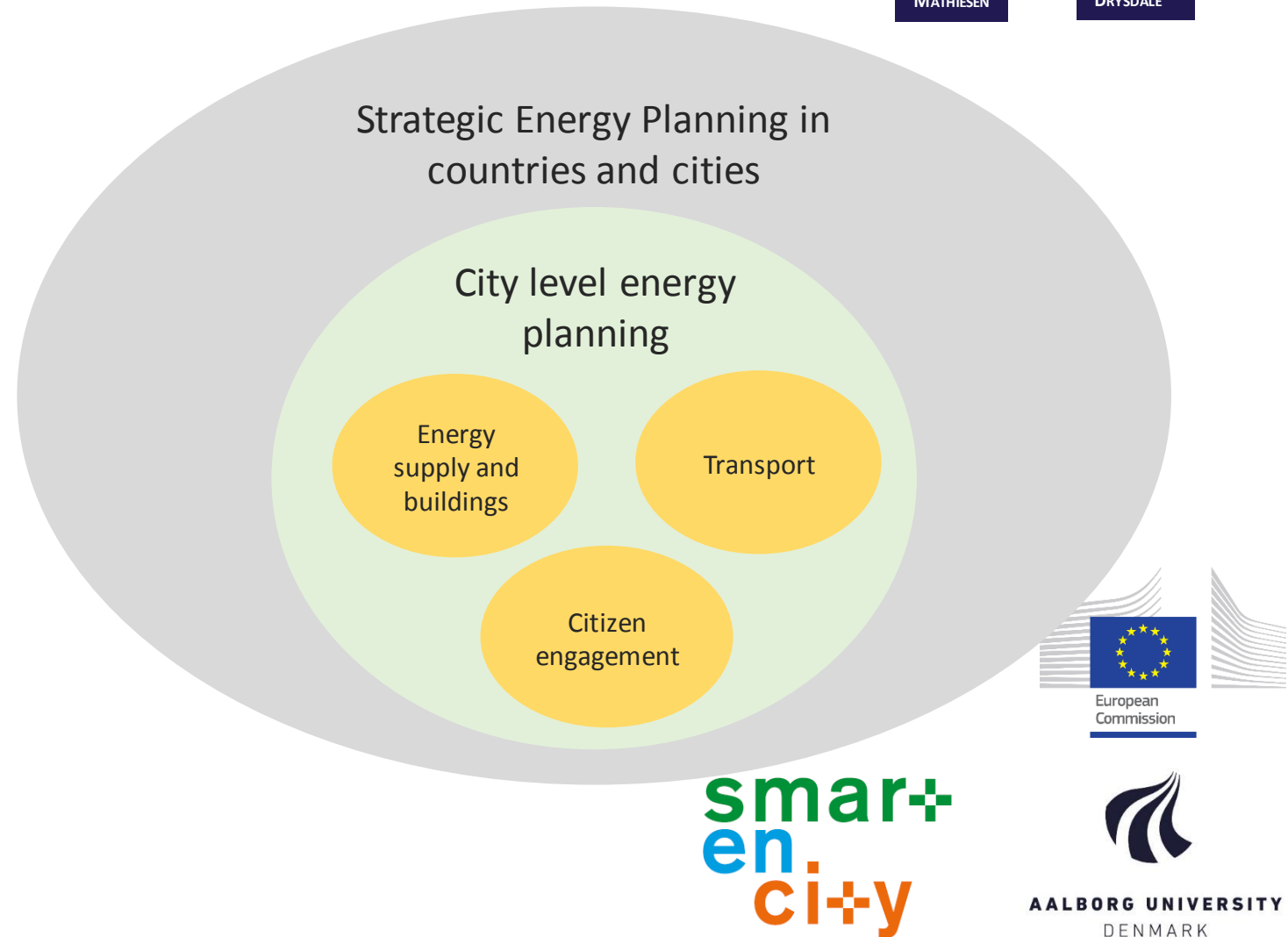
DAVID  
DRYSDALE

- They are being carried out to share the knowledge of the SmartEnCity partners and attract members to the network
- All webinars available online
- These webinars are for city planners, policy-makers, private companies, government, researchers etc.



# Topics of the webinars

1. Strategic Energy Planning in countries and cities
2. City level energy planning
3. Energy supply and buildings
4. Transport
5. Citizen engagement



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

# Overview of today's webinar



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- Introduction to the SmartEnCity Project
- **Who is the Sustainable Energy Group at Aalborg University?**
- Why do we need Strategic Energy Planning?
- What is Strategic Energy Planning?
- Summary
- Next webinars



# Our work

- Involved in Danish energy planning and design and implementation of Danish energy policy at local and national for +30 years
- Today we focus on integrating 1) energy system analyses 2) feasibility studies and 3) public regulation analyses in Denmark and EU
- We do numerous projects in Denmark and EU
  - Copenhagen Energy Vision 2050
  - Aalborg Energy Vision 2050
  - CITIES
  - Heat Roadmap Europe is focused on renewable heating and cooling in 14 largest European countries
- We develop EnergyPLAN a free tool we use to do highly renewable energy system analyses in countries and cities



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE





# Our role in SmartEnCity



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- Contributing with our knowledge to work packages
- Doing webinars, giving advice, contributing to reports
- We are spreading our knowledge throughout Europe and around the world
- Your input from the local level is important to enhance our research



# Overview of today's webinar



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- Introduction to the SmartEnCity Project
- Who is the Sustainable Energy Group at Aalborg University?
- **Why do we need Strategic Energy Planning?**
- What is Strategic Energy Planning?
- Summary
- Next webinars



# Why do we need Strategic Energy Planning?



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- The challenge is that we want to transition to low carbon countries at least cost and lowest resource use but this is complex
- We need to transition cities to low carbon economies which will decrease the country's carbon emissions



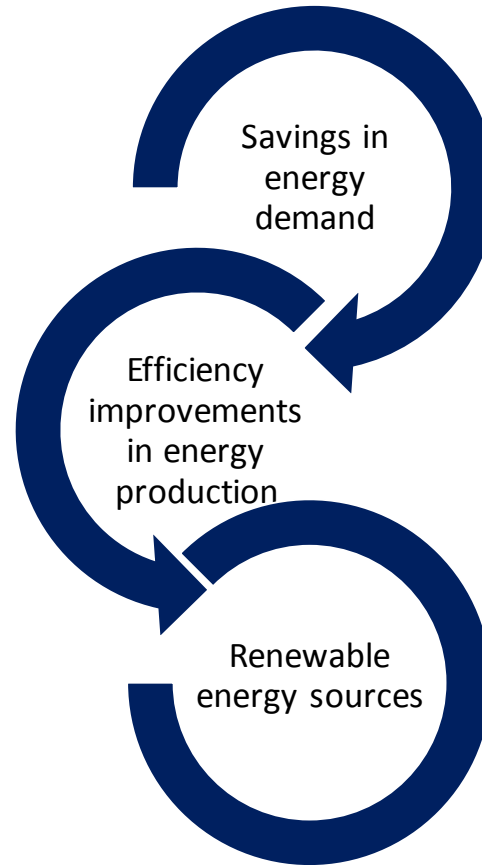
# How can we lower carbon emissions in cities?



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE



smar+  
en  
ci+y



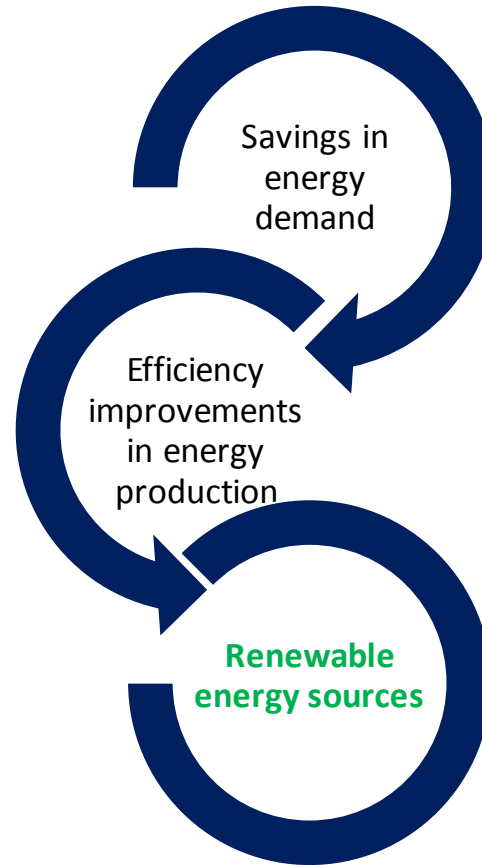
# How can we lower carbon emissions in cities?



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE



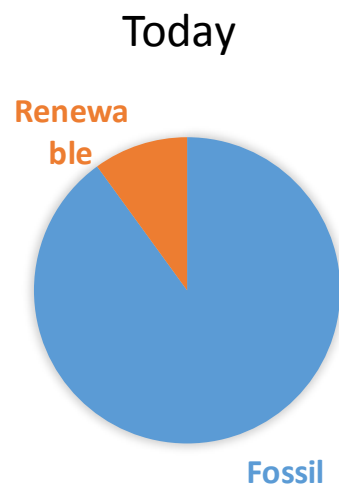
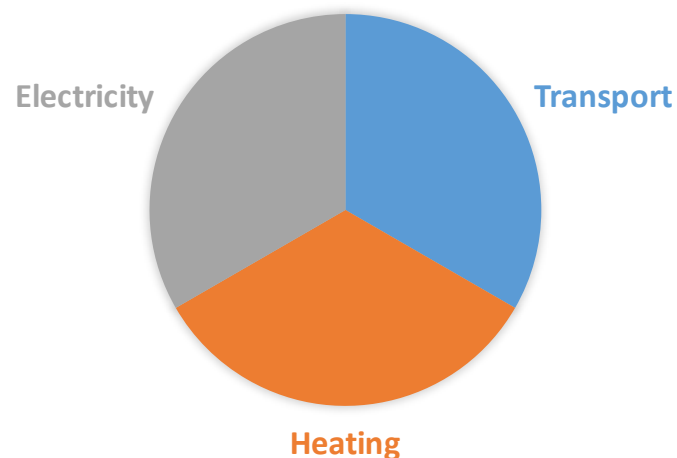
# How can we lower carbon emissions in cities? - Carbon neutral cities



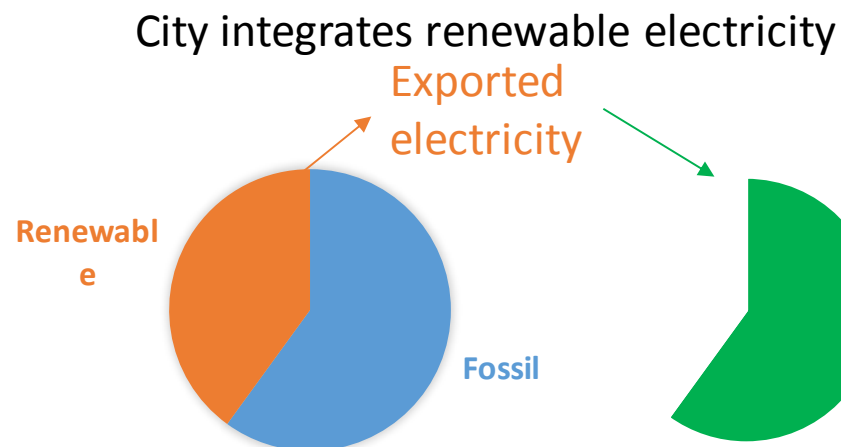
BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE



Transition to  
carbon  
neutral



Exported  
electricity



Fossil emissions  
offset with exported  
renewable electricity

smar+  
en  
ci+y



AALBORG UNIVERSITY  
DENMARK

# How can we lower carbon emissions in cities? - Carbon neutral cities



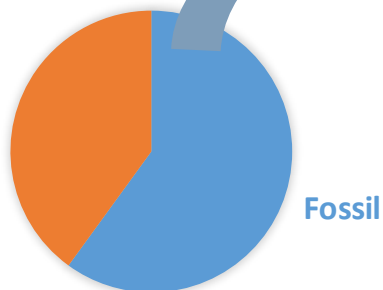
BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

City 1

Renewable



Fossil

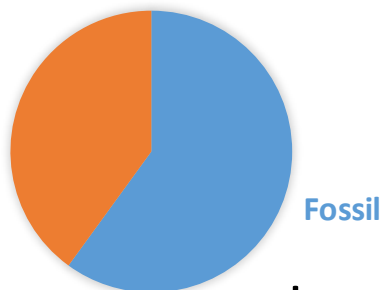
+



Fossil  
emissions  
offset with  
exported  
renewable

City 2

Renewable



Fossil

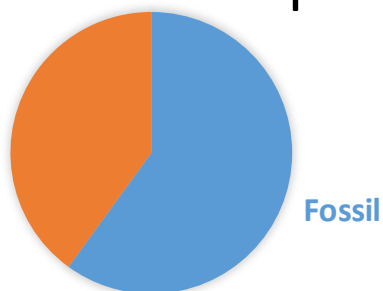
+



Fossil  
emissions  
offset with  
exported  
renewable

City 3

Renewable

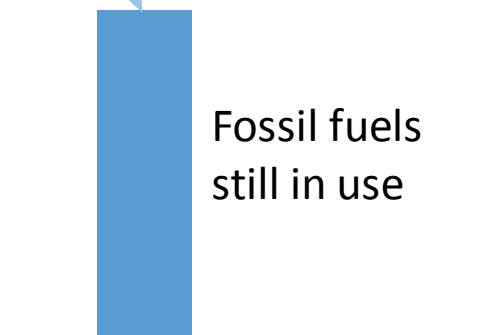


Fossil



Fossil  
emissions  
offset with  
exported  
renewable

=



Fossil fuels  
still in use



smart  
en  
city



AALBORG UNIVERSITY  
DENMARK

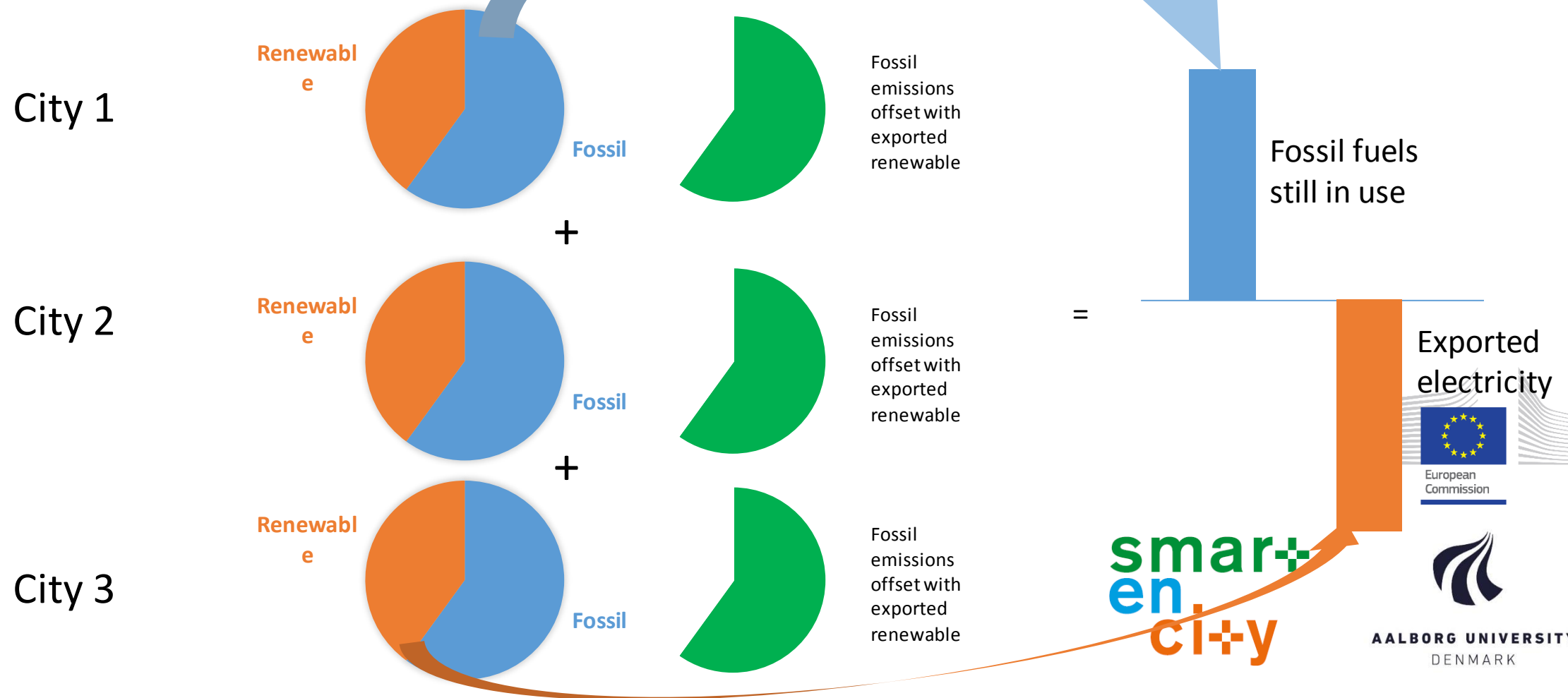
# How can we lower carbon emissions in cities? - Carbon neutral cities



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE





# How can we lower carbon emissions in cities? - Carbon neutral cities

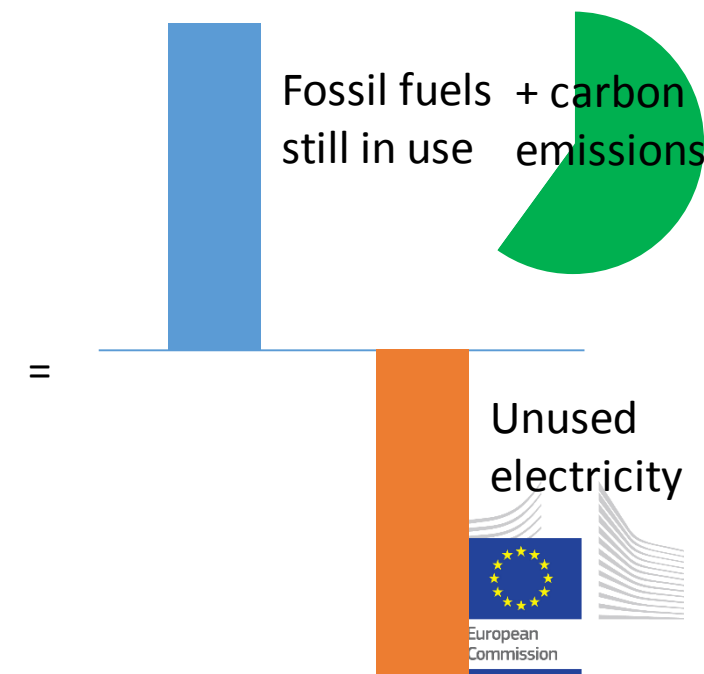
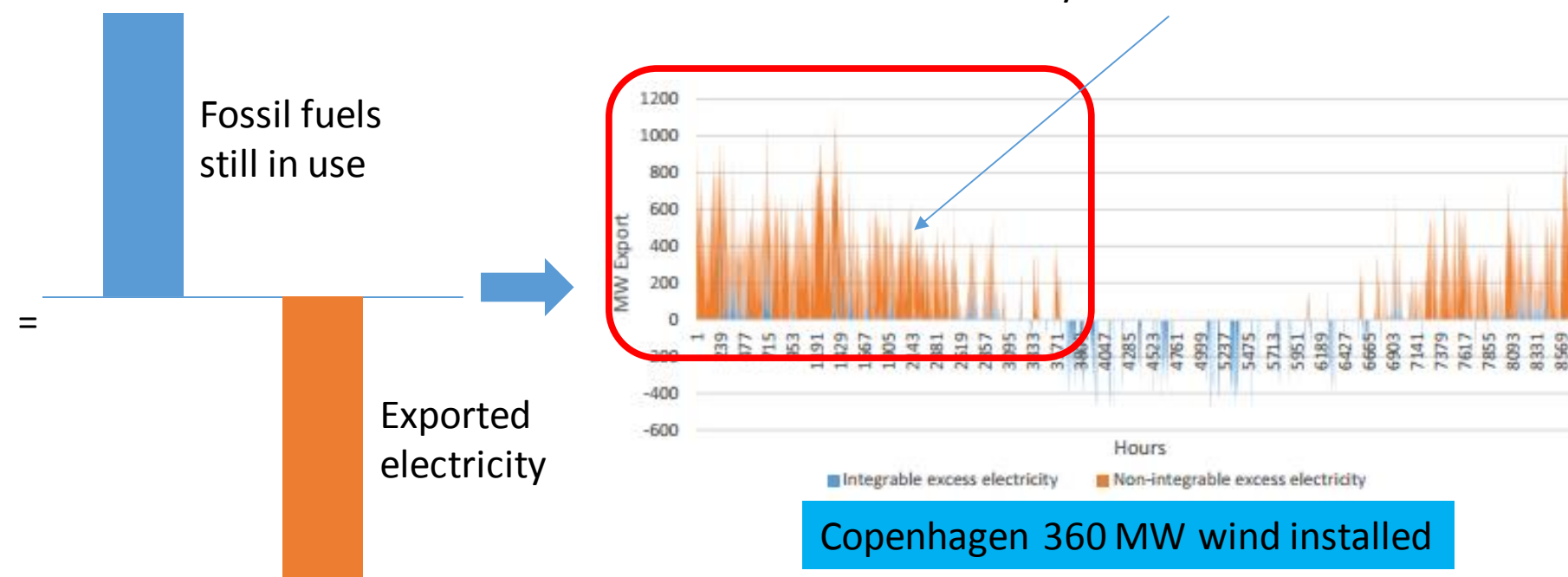


BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

Orange means the wind cannot be integrated into the national system



# How can we lower carbon emissions in cities? Energy storage



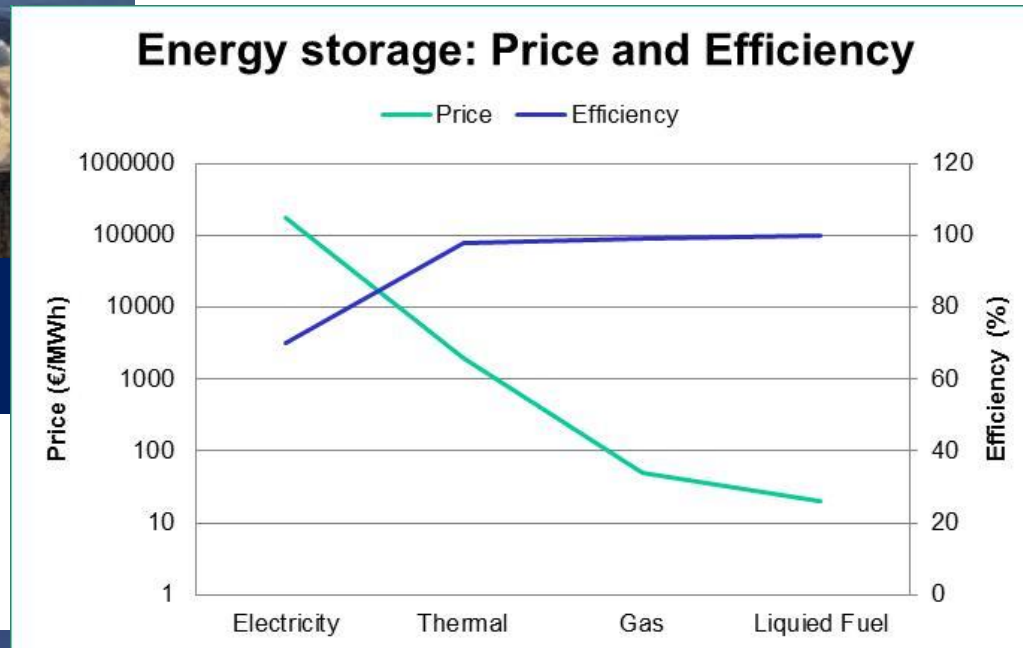
BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE



PUMP HYDRO STORAGE  
175 €/KWH



THERMAL  
STORAGE  
1-4 €/KWH



NATURAL GAS  
UNDERGROUND STORAGE  
0.05 €/KWH



OIL TANK  
0.02 €/KWH



# Better planning is needed to...



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- Reduce end use energy demand
- Ensure optimal renewable energy integration
- Utilise renewable energy to its full potential
- Have the least cost outcomes and maximise benefits from investments
- Place energy efficiency efforts in the right place
- Achieve the expected outcomes
- Realise all the opportunities with local resources and between regions



# Overview of today's webinar



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- Introduction to the SmartEnCity Project
- Who is the Sustainable Energy Group at Aalborg University?
- Why do we need Strategic Energy Planning?
- **What is Strategic Energy Planning?**
- Summary
- Next webinars



# What is a Strategic Energy Plan?



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- A tool for **planning and prioritising different development and investment pathways** for local energy demand and supply
- **Aligns** national energy objectives with local municipal energy planning
- It involves scenario analyses and **long-term planning**
- It involves **collaboration within and between cities and regions and other actors** *and central government*
- It creates an **in-depth understanding of the energy challenges** faced at the local level
- It brings increased understanding of the **opportunities with local resources and between regions**
- It involves developing a form of "**Master plan**"



# Three important phases in a Strategic Energy Plan



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

Phase 1: Develop a concrete **long-term national energy strategy**

Phase 2: **Detailed mapping** of the contents of all municipal plans

Phase 3: **Define goals** for municipal and inter-municipal level within strategic energy plan

- The Strategic Energy Plan is developed over time through continuous improvement
- The phases can be done in different stages



# Develop a concrete long-term national energy strategy



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

Phase 1: Develop a concrete **long-term national energy strategy**

Phase 2: Detailed mapping of the contents of all municipal plans

Phase 3: Define goals for municipal and inter-municipal level within strategic energy plan

1. Conduct a national level energy system analysis
2. Identify overall priorities and specific targets
3. Update the analysis and strategy over time as new developments occur

**100% renewable energy Denmark target and analysis**

**Energy savings, CHP, district heating, offshore wind, heat pumps, etc.**

**2006, 2009, 2011, 2015**



**SUSTAINABLE DEVELOPMENT GOALS**

**smar+  
en  
ci+y**



**AALBORG UNIVERSITY  
DENMARK**

# Develop a concrete long-term national energy strategy



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

Phase 1: Develop a concrete **long-term national energy strategy**

1. Conduct a national level energy system analysis
2. Identify overall priorities and specific targets
3. Update the analysis and strategy over time as new developments occur

**100% renewable energy Denmark target and analysis**

**Energy savings, CHP, district heating, offshore wind, heat pumps, etc.**

**2006, 2009, 2011, 2015**

Phase 2: Detailed mapping of the contents of all municipal plans

Phase 3: Define goals for municipal and inter-municipal level within strategic energy plan





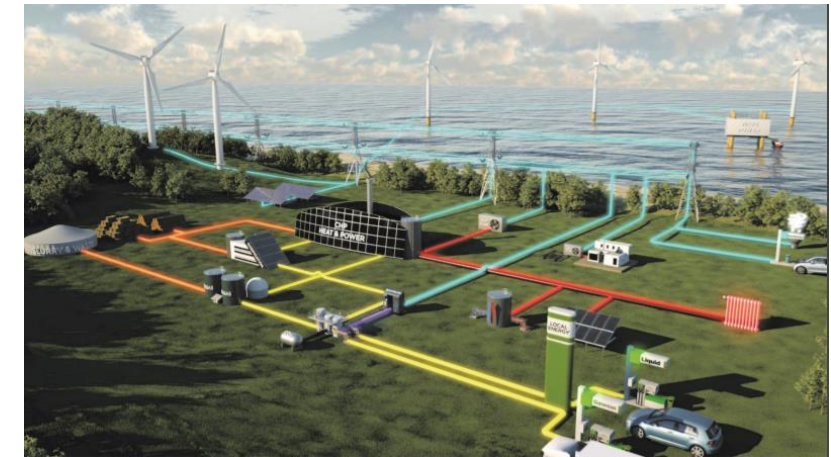
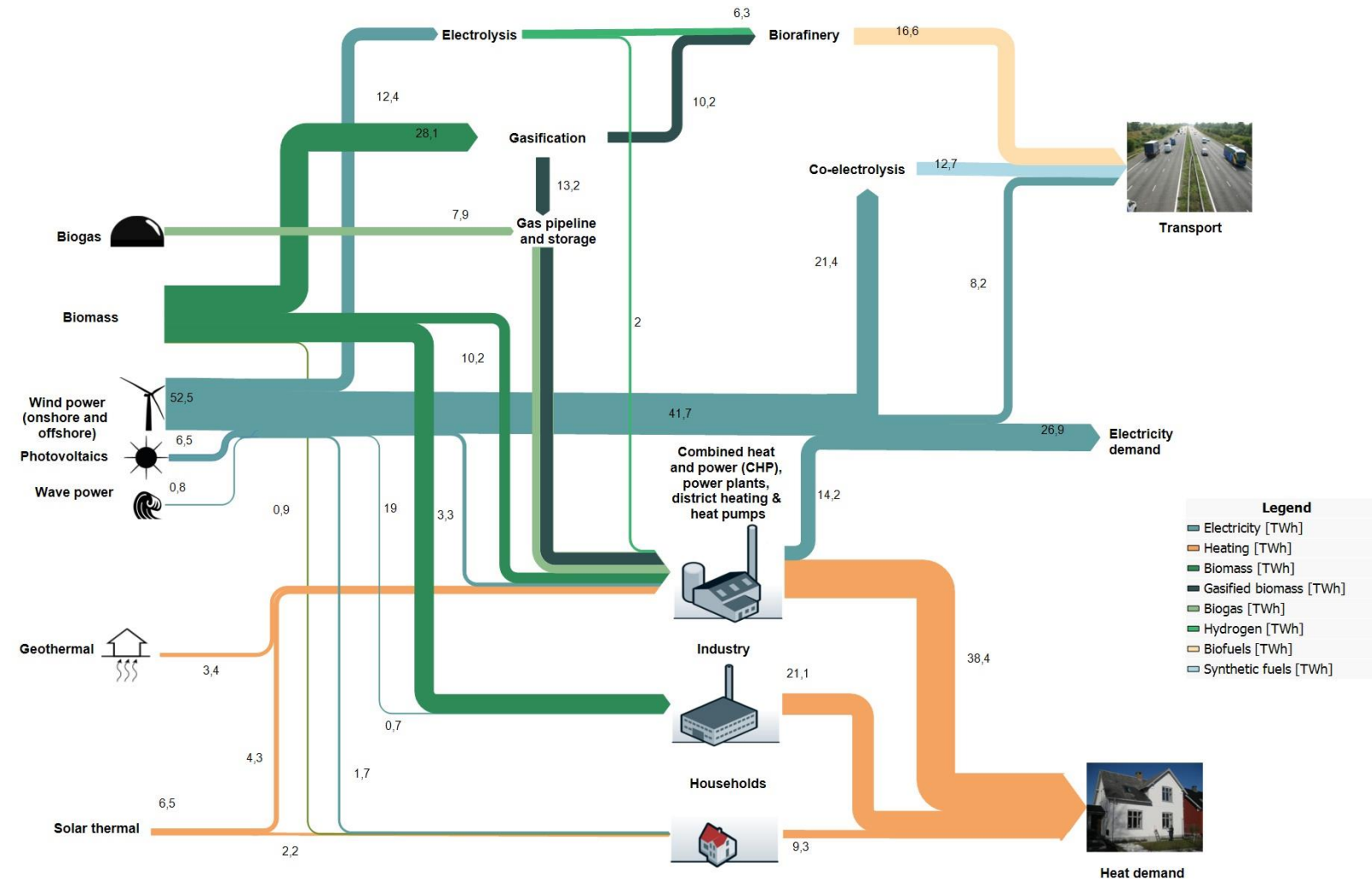
# 100% renewable energy system



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE



[Video](#)

[www.smartenergysystems.eu](http://www.smartenergysystems.eu)



smar+  
en  
ci+y



# Detailed mapping of the contents of all local plans



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

Phase 1: Develop a concrete long-term national strategy

Phase 2: **Detailed mapping** of the contents of all municipal plans

Phase 3: Define goals for municipal and inter-municipal level within strategic energy plan

1. Develop a network between, municipal governments, relevant actors and central government
2. Map the contents of municipal plans in terms of resources, goals and ambitions

Regional network was developed

Each municipality provides knowledge about their region supported by other actors like PlanEnergi





BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE



smar+  
en  
ci+y



AALBORG UNIVERSITY  
DENMARK

# Define goals for municipal and inter-municipal level within strategic energy plan



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

Phase 1: Develop a concrete long-term  
national strategy

Phase 2: Detailed mapping of the  
contents of all municipal plans

Phase 3: **Define goals** for municipal and  
inter-municipal level within strategic  
energy plan

1. Define specific goals in the long term strategy
2. Assign specific tasks to the relevant actors
3. Implement projects on the basis of the strategic energy plan

**In Denmark the Regions or regional network organisations have facilitated the cooperation and actions of the municipalities**





14 partnership projects for strategic energy planning have been carried out in the period 2014-2015.



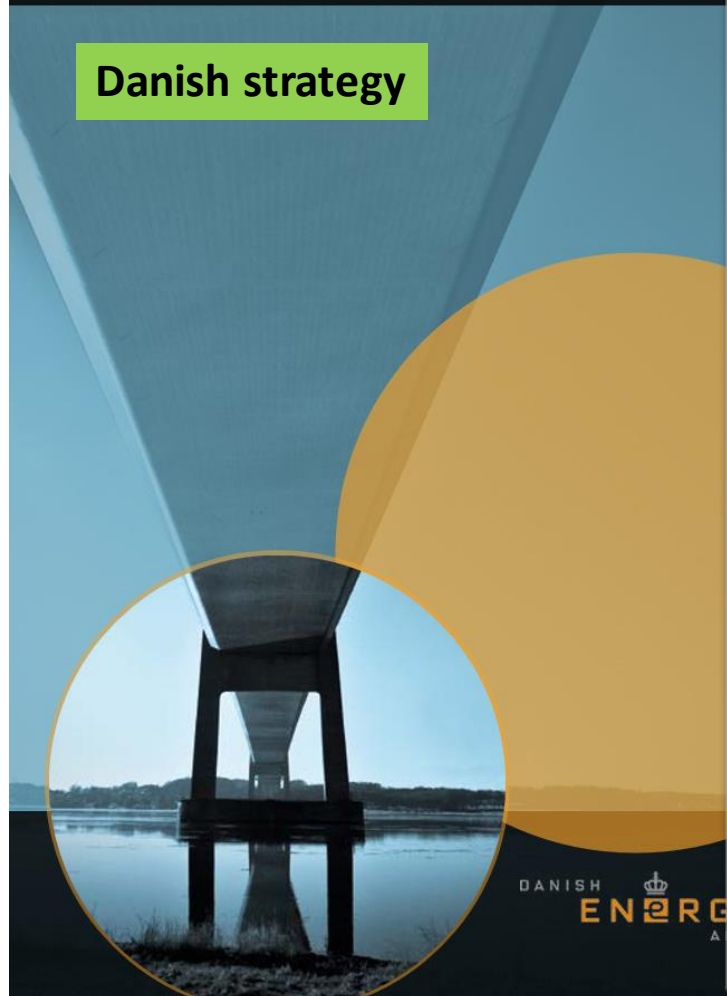
BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

## STRATEGIC ENERGY PLANNING IN DENMARK AT MUNICIPAL AND REGIONAL LEVEL

Danish strategy



## midt.energistrategi

Strategisk energiplanlægning  
på tværs af kommuner og  
aktører i Region Midtjylland

Regional strategy



smar+  
en  
ci+y



# Overview of today's webinar



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- Introduction to the SmartEnCity Project
- Who is the Sustainable Energy Group at Aalborg University?
- Why do we need Strategic Energy Planning?
- What is Strategic Energy Planning?
- **Summary**
- Next webinars



# Summary

## – The problem we face

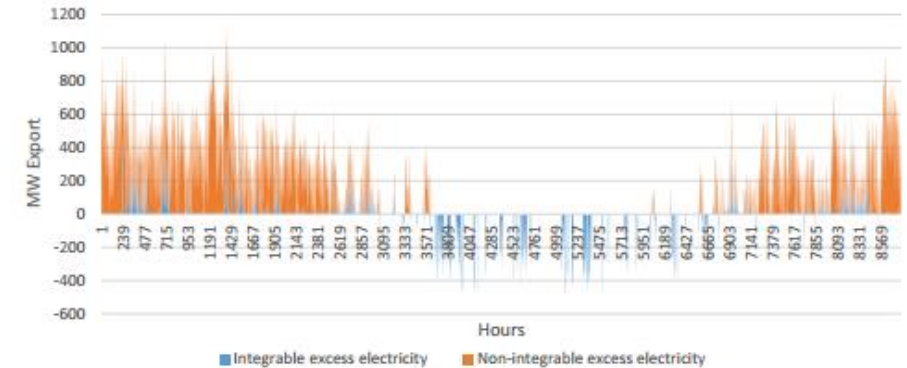


BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- Cities want to be low carbon
- We need to integrate renewable energy, save energy, store energy and create flexibility in the system
- We need to think about cities as part of a wider energy system
- Without a proper plan it could be costly and ineffective



# Summary

## – The opportunity we have



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- Numerous benefits can be achieved through collaboration
- Energy system knowledge is available and can be shared in collaborations
- Networks are being developed now to share knowledge and create collaborations
- Today Strategic Energy Planning is being done and we can learn from these experiences
- Strategic Energy Planning can be improved continuously over time

Phase 1: Develop a concrete **long-term national energy strategy**

Phase 2: **Detailed mapping** of the contents of all municipal plans

Phase 3: **Define goals** for local and inter-municipal level within strategic energy plan

smar+  
en  
ci+y



AALBORG UNIVERSITY  
DENMARK



# Summary

## – Start with imperfect planning



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE

- Do analyses of the energy system to identify priorities and goals
- Try to establish communication channel with neighbouring cities/municipalities and to the central administration
- Help central administration by providing local bottom-up knowledge about energy system needs and potentials
- Push for right framework conditions from above from the local level
- Continue with current initiatives such as energy efficiency, use of local resources
- Identify benefits to local economy, businesses
- Involve new actors, e.g. local citizen involvement and ownership



Join the SmartEnCity network



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE



<http://smartencity.eu/network/>

Sign up for the newsletter

<http://smartencity.eu/press-corner/newsletter/>

Thank you...questions?

Email: [bvm@plan.aau.dk](mailto:bvm@plan.aau.dk), [drysdale@plan.aau.dk](mailto:drysdale@plan.aau.dk)

Twitter: @brianvad



# Next webinars...



BRIAN VAD  
MATHIESEN



DAVID  
DRYSDALE



smar+  
en  
ci+y



AALBORG UNIVERSITY  
DENMARK