



FutureGas WP4

May 2018

WORK IN WP4

Main activities in WP4

Work carried out in relation to WP4 includes:

- Journal papers
- Popular Article
- Conference proceedings
- Awards
- Presentations
- Master Theses
- Workshops

Journal Papers

Three papers have been published, two have been submitted to Journals and there is one more on the way.

- **Modelling of renewable-gas and -fuels in integrated energy systems**
Will be submitted to a Journal
- *Rasmus Bramstoft, Amalia Pizarro Alonso, Ida Græsted Jensen, Hans Ravn, Marie Münster.*
Focus: The aim of this paper is to model RE-gas which can be 1) used for electricity and heat generation, 2) be injected in the natural gas grid, and 3) used as feedstock for RE-fuels (such as methanol and FT-biodiesel).
- **Baltimore open source energy system model**
Published: "Energy Strategy Reviews"
- *Frauke Wiese, Rasmus Bramstoft, Hardi Koduver, Amalia Pizarro Alonso, Olexandr Balyk, Jon Gustav Kirkerud, Åsa Grytli Tveten, Torjus Bolkesjø, Marie Münster, Hans Ravn.*
Energy Strategy Reviews 20 (2018) 26-34
<https://doi.org/10.1016/j.esr.2018.01.003>
Focus: The aim of this paper is to describe the modelling approach, applications, strengths, limitations, and potential future development of the Baltimore modelling tool.

- **STREAM – an energy scenario modelling tool**
Published: "Energy Strategy Reviews"
- *Rasmus Bramstoft, Amalia Pizarro Alonso, Kenneth Karlsson, Anders Kofoed-Wiuff, Marie Münster.*
Energy Strategy Reviews 21 (2018) 62-70
<https://doi.org/10.1016/j.esr.2018.04.001>
Focus: The aim of this paper is to describe the modelling approach, applications, strengths, limitations, and potential future development of the STREAM modelling tool.
- **Decarbonizing Sweden's energy and transportation system by 2050**
Published: "International Journal of Sustainable Energy Planning and Management"
- *Rasmus Bramstoft, Klaus Skytte.*
International Journal of Sustainable Energy Planning and Management Vol. 14 2017 03-20
[doi: dx.doi.org/10.5278/ijsep.2017.14.2](https://doi.org/10.5278/ijsep.2017.14.2)
Focus: This paper develops 100% renewable scenarios for Sweden's transportation sector by 2050. The energy system model STREAM is utilized to compute the socioeconomic system cost and simulate an integrated transportation, electricity, gas, fuel refinery, and heat system.
This study is prepared as part of the FutureGas, Flex4RES, and TOPNEST research projects.

➔ Decarbonisation options in the industry sector and conceptual model of industry in an integrated energy system model

Review "[Journal of Cleaner Production](#)"

- **Frauke Wiese, Mattia Baldini.**

Focus: The aim of the paper is to describe an extension of the energy system model Balmorel, to consider the fuel, electricity, space and process heat demand of the industrial sector and its impact on the energy system.

Popular Article in Magazine

A popular is submitted to the Gas-for-Energy Magazine, after being invited based on the conference presentation at IGRC2017.

➔ FutureGas – The integration of gas in the future Danish energy system

Published in "Gas for Energy"

- **Poul Erik Morthorst, Marie Münster, Tara Sabbagh Amirkhizi, Rasmus Bramstoft.**

Focus: The aim of this article is to present the FutureGas project. The article highlights that FutureGas will provide future pathways for the Danish energy transition towards a sustainable future, with a detailed representation of the gas system as an integrated part of the future energy system. A part of the article describes the conceptual model which is developed – and was presented at the IGRC2017 conference.

Conference Proceedings

Four papers are submitted as conference proceedings. Two of the conference papers was presented at the International Gas Union Research Conference – Rio 2017, Brazil (IGRC 2017). Another conference will be presented in October at the SDEWES - 12th Conference on sustainable development of energy, water and environment systems in Dubrovnik, Croatia (SDEWES 2017). The last conference paper was presented at the 26th European Biomass Conference and Exhibition, Copenhagen, Denmark (EUBCE 2018).

➔ Pathways to Carbon Neutral Industrial Sectors: Integrated Modelling Approach with High Level of Detail for End-use Processes

Presented at **SDEWES 2017**, October 2017.

Archival paper.

- **Frauke Wiese, Mattia Baldini.**

Focus: A detailed modelling approach for energy usage in industry is presented. The paper itself focuses on different demand profiles for electricity and heat demand of different temperature levels and different industrial groups. It is the first part of the ongoing work for detailed industrial energy modelling in Balmorel.

➔ Modelling of renewable gas in the future energy system

Presented at **IGRC 2017**, May 2017

- **Rasmus Bramstoft, Amalia Pizarro Alonso, Ida Græsted Jensen, Hans Ravn, Marie Münster.**

Focus: Modelling framework for RE-gas production is implemented in OptiFlow, which further is co-simulated with Balmorel to obtain socioeconomic optimal solutions for the integrated energy system. This conference paper is the first version of the paper "**Modelling of renewable-gas and -fuels in integrated energy systems**".

➔ Conceptual model of the gas system as an integrated part of the future Danish energy system

Presented at **IGRC 2017**, May 2017

- **Marie Münster, Rasmus Bramstoft, Frauke Wiese, Poul Erik Morthorst.**

Focus: Based on a literature review of energy system models, gas models, and integrated gas and electricity models, this paper develops the conceptual model of the future gas system includes, production, conditioning, transmission, storage, trade and use. The conceptual model will be implemented in Balmorel and OptiFlow.

➔ Towards a sustainable future – the role of biomass in future renewable based energy systems

Presented at **EUBCE 2018**, May 2018

- **Rasmus Bramstoft, Marie Münster.**

Focus: In this paper, bioenergy is modelled as an integrated part of the future energy system, through a co-simulation of the comprehensive energy system model, Balmorel, and the generalised spatiotemporal network optimisation model, OptiFlow. The results of this study show that biomass plays a key role in particular when transforming the transportation sector to a renewable-base sector. To efficiently utilise the limited biomass resource, hydrogen is used to boost the biofuel production. Moreover, the results show that biogas is produced, updated and injected into the gas grid.

Awards

➔ **8th GERG Young Researchers Award**, where the prize was awarded by the European gas research group, GERG. The award was given for the innovative project in the field of renewable or other low-carbon gas. The 8th GERG Young Researchers Award event took place in association with the Eurogas Annual Conference on 27th October in Brussels.

➔ **EUBCE Student Award (2018)**. The EUBCE Student Award is awarded for the excellent research work in the field of biomass, and was given on the occasion of EUBCE 2018 Conference.

Other Presentations (selected)

A long list of presentations has been given at different conferences, workshops, meetings, etc. Here is some of the most important listed.

Other conference presentations:

➔ **Role of gas in sector coupling and in renewable transport**
Presented at: 7.EUM Fachtagung –Zauberformel Sektorkopplung, der nächste Schritt zu 100% EE (7. Energy- and Environmental Management Conference – Sector-coupling, the next step to 100% renewable energy systems) – Flensburg, Germany, March 2017
- Frauke Wiese.

➔ **Open tools required for integrated energy modelling / Workshop on modelling tools for gas in integrated energy systems**

Presented at: European Open Energy Modelling Workshop, Frankfurt, Germany, April 2017
- Frauke Wiese.

Other presentations:

- "The FutureGas project" - European Research Institute for Gas & Energy Innovation (ERIG) network workshop, Brussels, 2016
- Marie Münster.
- "The FutureGas project" Meeting in the energy storage and distribution group under the The Danish Partnership for Hydrogen and Fuel Cells, HMN Copenhagen, 2016
- Marie Münster.
- "System aspects related to the future role of the gas system" GasAkademin, Sweden 2017
- Marie Münster.
- "Towards a sustainable future – the role of renewable gas in future Danish energy systems" GERG – 8th Young Research Award Event, Eurogas annual conference, Brussels 2017
- Rasmus Bramstoft.
- "Comparison of future technologies for shipping", Fremtidens grønne transport til lands og til vands, Energiens Hus – København, 2017
- Frauke Wiese.
- "Modellerings resultater (fra FutureGas)" Dansk Gastekniske Dage, Billund 2018
- Rasmus Bramstoft.

Master Thesis Supervision

- **Pathways to low carbon maritime transport in Denmark**
Student: Alfie Wisdom (DTU)
Supervisors: Marie Münster, Frauke Wiese.
- **Pathways to low carbon maritime transport in Denmark**
Student: Till ben Brahim (University of Flensburg)
Supervisors: Frauke Wiese (DTU) in collaboration with Niels Træholt Franck and Thomas Young Hwan Westring Jensen (Energinet).

Workshops

- **Transport in integrated energy system modelling**
The workshop was held at DTU in January 2017. Experts within modelling of transportation in integrated energy systems was invited. The workshop included presentations and discussions. The outcomes from the workshop is summarized in a small report.
- **CITIES/FutureGas Joint Seminar: Modeling and Optimization of Integrated Energy Systems**
The workshop was held at DTU in 15 December 2017. The purpose was to share knowledge about modelling and optimization of integrated energy systems.
- **Scenario workshop**
Two scenario workshops has been held, one in connection with the project kick-off meeting in 2016 and one in connection with the annual meeting in 2017. Subsequently, a scenario report has been developed.
- **Workshop on modelling and temporary results**
The workshop was held at DTU in May 2018. All project participants were invited. The workshop included presentations and discussions. Presentations are uploaded on Sharepoint.

INFORMATION

Find all above articles, presentations and reports at FutureGas Sharepoint – WP4 Outputs