Bioenergy systems
We look into ways through which the bioenergy potential can be realized in countries at different levels of development. We look into policies, technologies, industrial synergies, and creative ways to foster collaboration among countries towards the implementation of global and local social and environmental agendas.

Energy for sustainable development
We are exploring ways to promote electrification in developing countries particularly looking into policies, institutional organization and investment options. We analyze the development of markets for renewable options in developing country contexts and develop indicators to monitor policy implementation.

Energy systems efficiency
We are particularly interested in how different industrial sectors are evolving, and what the implications are in terms of energy demand and greenhouse gas emissions. In this context, we analyze energy efficiency improvement potentials and related requirements in terms of technological change and incentives to make it all happen.

Urban Sustainability
We focus on the development of livable and attractive cities with better integration of energy services into urban functions and industrial production. In this context, it is important to deliver energy services with high standards of safety, reliability and convenience, while also improving efficiency and reducing negative environmental and health impacts.

Master’s study profile – Transformation of Energy Systems
A study profile for the MSc. Program Sustainable Energy Engineering (SEE) is offered in cooperation with other institutions at KTH focusing on energy policy and planning, modelling and management. Brazilian exchange students can choose to follow this profile.

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Smart City Concepts in Curitiba

– innovation for sustainable mobility and energy efficiency –

Transport and IT-based technologies open opportunities to rethink the development of cities. A consortium between Swedish and Brazilian stakeholders is exploring the deployment of these technologies together with new concepts for urban planning in Curitiba, Brazil. The project aims at sustainable technological solutions for the improvement of urban infrastructure.

About the project Smart City Concepts in Curitiba

In 2013, KTH, the City of Curitiba and institutions including local universities and the Federation of Industries of the State of Paraná signed a Memorandum of Understanding to develop projects in the areas of mobility, urban planning and environment. The MoU was signed in the presence of His Majesty King Carl XVI Gustaf of Sweden, the Mayor of Curitiba Mr. Gustavo Fruet, and a distinguished delegation composed of Swedish universities and industries. Since then, a consortium has been formed including KTH Royal Institute of Technology, VOLVO, SAAB Combitech, UTFPR (Federal University of Technology – Paraná), URBS (Urbanization of Curitiba S/A) and IPPUC (Urban Planning and Research Institute of Curitiba) to explore the deployment of technologies for improved mobility and energy efficiency in Curitiba, Brazil.

Project team

- Prof. Semida Silveira, Project leader, KTH-ECS
- Prof. Keiko Fonseca, Co-project leader, UTFPR
- Dennis Dreier, KTH-ECS
- Prof. Lena Wosinska, KTH-ONLab
- Prof. Paolo Monti, KTH-ONLab
- Dr. Matteo Fiorani, KTH-ONLab
- Prof. Ricardo Lüders, UTFPR
- Prof. Tatiana Gadda, UTFPR
- Ingemar Johansson, COMBITECH
- Björn Rudin, COMBITECH
- Alessandra Holmo, CISB
- Juliana Miura, CISB
- Angelo Souza, CISB
- Rafael Niewegowski, VOLVO BUSES
- Jessica Sandström, VOLVO BUSES
- Renan Schepanski, VOLVO BUSES
- Vinicius Gaensly, VOLVO BUSES
- Fabio Doria Scatolin, CITY OF CURITIBA
- Rosane Kupka, CITY OF CURITIBA
- Gregorio da Silva Junior, URBS
- Silvia Mara dos Santos Ramos, URBS
- Elcio Karas, URBS
- Sergio Pires, IPPUC
- Luisiana Paganelli Silva, IPPUC
Energy use and CO₂ emissions of city buses in Curitiba, Brazil

Dennis Dreier a,*, Semida Silveira a, Dilip Khatiwada a, Keiko V.O. Fonseca b, Rafael Niewegowski c, Renan Schepanski c

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b Federal University of Technology – Paraná, Curitiba, Brazil
c Volvo Bus Corporation, Curitiba, Brazil

* Corresponding author (dennis.dreier@energy.kth.se)

Energy and Climate Studies Unit
Department of Energy Technology
School of Industrial Engineering and Management (ITM)
The division of Energy and Climate Studies (ECS) has an interdisciplinary character with a strong systems approach, linking issues related to energy technology and policy, climate change and sustainable development.

www.ecs.kth.se

Energy and climate policy
- Energy systems efficiency
- Development.

Energy and Climate Studies Unit
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Demonstration of new technology for mass transport corridors

System innovation, combining new bus-technologies and information technology to develop electro-mobility, and energy efficient and low-carbon transport services are needed when making urban sustainability a reality. Data collection and analysis of real-world bus operations are carried out to evaluate particular benefits of new bus technologies introduced in Curitiba.

- One hybrid articulated bus operating since the 18 March 2016.
- One plug-in hybrid-electric bus will be launched on 29 June 2016.

Planning of plug-in hybrid-electric bus operation

Evaluation of different scenarios for bus rapid transit operation with plug-in hybrid-electric buses for public transport using computer simulation models. Based on the simulation, charging stations will be added to the terminal and the effect on the traffic flow as well as strategies for mitigating these will be identified.

- A model of the Pinheirinho Terminal is being developed for simulations.

Providing high-capacity wireless broadband along Curitiba transportation corridors

Investigation of deployment strategies using fiber-based aggregation network for ubiquitous urban wireless broadband connectivity.


Energy and climate scenarios with improved environment and mobility

Analysis of energy efficiency and greenhouse gas emissions reduction in different scenarios for the bus rapid transit system in Curitiba, with focus on alternative fuels and electrification.

- Dreier (2015). Assessing the potential of fuel saving and emissions reduction of the bus rapid transit system in Curitiba, Brazil.

ICT infrastructure for Open Data integration and interactive information sharing

Green and resilient design for optical cloud and wireless network services.

- Silva et al. (2016). Restoration in Optical Cloud Networks With Relocation and Services Differentiation. (Published in: Journal of Optical Communication and Networking).

Planning of electro-mobility in Curitiba

Analysis and mapping of road safety, noise, bus routes, bus stops, roads, commercial activities, noise sensitive activities, slopes, and air emissions to identify suitable places for investing in electro-mobility.

The importance of connectivity in cities

• Once high capacity broadband infrastructure is in place, it will be possible to develop a number of applications to improve the quality of life of the citizens.

High capacity infrastructure

Development of applications

Improvement of life quality

Application in Sweden and Brazil

• Access to broadband connectivity is considered as a commodity nowadays
• End users are expecting to be able to have access to high bandwidth services regardless of their locations and mobility conditions
• Need for very high capacity wireless broadband connectivity
• In Sweden the ubiquitous wireless broadband connectivity is quite advanced
• Brazil can follow closely if the right steps are taken
• In the Smart City Concepts in Curitiba project, ICT focus on efficient ways to deploy and manage an ICT infrastructure able to answer this need.

Future scenarios for Curitiba

• Example: Smart networked systems for road traffic:
  ➢ Optimized and cognitive decision-making system
  ➢ Runs virtually everywhere to detect and prevent accidents
  ➢ Build on ICT infrastructure
  ➢ Support of the most stringent requirements: Reaction time and robustness
• The involved systems consist of:
  ➢ Networked road users (vehicles and pedestrians)
  ➢ Smart decision making systems controlling the situation on the road

General framework

• Providing powerful computing and communication resources on the fly
• Designing fast, intelligent and robust decision-making methods
• Building a common artificial intelligence-based information and communication system platform

Unified control plane and data plane architecture design

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Electric hybrid buses in Curitiba: an arena for testing new products and services in public transport

Rafael Nieweglowski a, Renan Schepanski a, Vinicius Gaensly a,
Keiko V.O. Fonseca b, Elcio Karas c, Paulo Rissio c

a Volvo Bus Corporation, Curitiba, Brazil
b Federal University of Technology – Paraná, Curitiba, Brazil
c Urbanization of Curitiba S/A, Curitiba, Brazil – URBS

Air conditioner
Wifi connectivity
Zone management (speed limit)
Less emissions
Less noise

Zero emission zone
Connected bus stop
Traffic studio
(monitoring with cameras and GPS)
Passenger information
(at stops, on board, via web-mobile)

A NEW EXPERIENCE OF PUBLIC TRANSPORT

INTERBAIRROS II

This line has two directions: (020) clockwise and (021) anticlockwise. Its route passes through over 25 districts of Curitiba, on a path that takes about two hours to be covered completely. It represents a massive transportation with high capacity buses.

NEW SPECIAL LINE
ELECTRICITY

Quiet and emission-free electric hybrid buses that contribute to a more pleasant urban environment. Includes future bus stop solutions, ITS solutions, safety concepts, green depot and energy solutions