

Dr. Aldo Bischi (Assistant Professor, Skoltech)

“Combined cooling, heat and power systems operation planning: Mixed Integer Linear Programming-MILP model”

Abstract. Combined Cooling, Heat and Power (CCHP) generation is an effective way to reduce primary energy consumption and carbon dioxide emissions. Such systems make rational use of primary energy generating simultaneously heat, electric/mechanical power and refrigeration effect.

Several types of prime movers are suitable for co-generative applications, ranging from micro-turbines to gas-steam turbine combined cycles. They can have more than one independent operative variable, highly nonlinear performance curves describing their off-design behavior, limitations or penalizations affecting their start-up/shut-down operations. The CCHP units may also depend on ambient temperature and may be integrated with heat pumps, renewable energy sources as well as heat and cooling load storage. In addition national and European Union incentive policies come into play.

Due to the large number of decision variables and the necessity of determining trade-off solutions, the operation planning of CCHP plants, with several units, requires the development of specific optimization tools. The Seminar will give an overview of how these challenges have been tackled developing a Mixed Integer Linear Programming (MILP) model by means of piecewise linearization of Non-Linear problems. The presented work has been carried on by a joint effort of Politecnico di Milano Groups of Energy Conversion Systems - GECOS and Operations Research.

Bio. Dr. Aldo Bischi, after his M.Sc. degree in Mechanical Engineering from “Università degli Studi di Perugia” (Italy), received his Ph.D. in “Energy and Process Engineering” from the Norwegian University of Science and Technology-NTNU (Norway) with a dissertation on Chemical Looping Combustion (CLC) reactor system design. An Innovative design for a 150kWth test-rig was proposed, consisting of two pneumatically controlled interconnected circulating fluidized beds. The design was finalized by the construction and commissioning of a full-scale cold flow model.

From 2012 until 2015 Dr. Bischi held a post-doctoral position in the “Group of Energy Conversion Systems” – GECOS at Politecnico di Milano (Italy), being awarded of a “Polimi International Fellowship”. He worked on distributed power generation: Combined Cooling, Heat and Power (CCHP) systems, dealing with all CCHP aspects from technical to economic point of view. Main objective was the development of mathematical models for the scheduling and design optimization of CCHP systems. In parallel he has been involved in several research projects and consultancies with industrial partners. Since academic year 2013/2014, he was responsible, as Adjunct Professor, for the course of “Energy and Environmental Systems” at the Politecnico di Milano master program in Management Engineering. Moreover, he has been involved, as lecturer and CCHP expert, in several executive courses in Italy and UK.

Dr. Bischi is currently Assistant Professor at Skolkovo Institute of Science and Technology, Skoltech, Moscow, (Russia) in the Center for Energy Systems (CES). His research activity will be within the field of energy conversion with focus on integrated gas-, heat- and electric- energy infrastructures.