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The share of renewable energy in the Danish energy sector is increasing and the goal is that biogas production should reach a production level of 17 petajoules (PJ) in 2020 according to the Danish Energy Agency. However, this goal is currently not reachable due to lack of investments in biogas plants. In this paper, a mixed integer programming (MIP) model for finding the optimal production and investment plan for a biogas supply chain is presented to ensure better economy for the full chain hopefully stimulating future investments in biogas. The model makes use of step-wise linear functions to represent capital and operational expenditures at the biogas plant; considers the chain from the farmer to the end market; and includes changes of mass and energy content along the chain by modeling the losses and gains for all processes in the chain. Biomass inputs are scheduled on a weekly basis whereas energy outputs are scheduled on an hourly basis to better capture the changes of energy prices and potentially take advantage of these changes. The model is tested on a case study with co-digestion of straw, sugar beet and manure, considering natural gas, heat, and electricity as end products. The model finds a production and investment plan for a predefined location of the plant within half an hour of central processing unit (CPU) time. The resulting project turns out to be profitable and gives a production plan for each process, which underlines the possibilities of optimizing the processes in a biogas project.

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