DTU Compute
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Forecasting and Control for Smart Energy Systems

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The Extended Linear Quadratic Control Problem

$$\min_{\{u_k, x_{k+1}\}_{k=0}^{N-1}} \quad \phi = \sum_{k=0}^{N-1} l_k(x_k, u_k) + l_N(x_N)$$

$$s.t. \qquad x_{k+1} = A_k x_k + B_k u_k + b_k \quad k \in \mathcal{N}$$

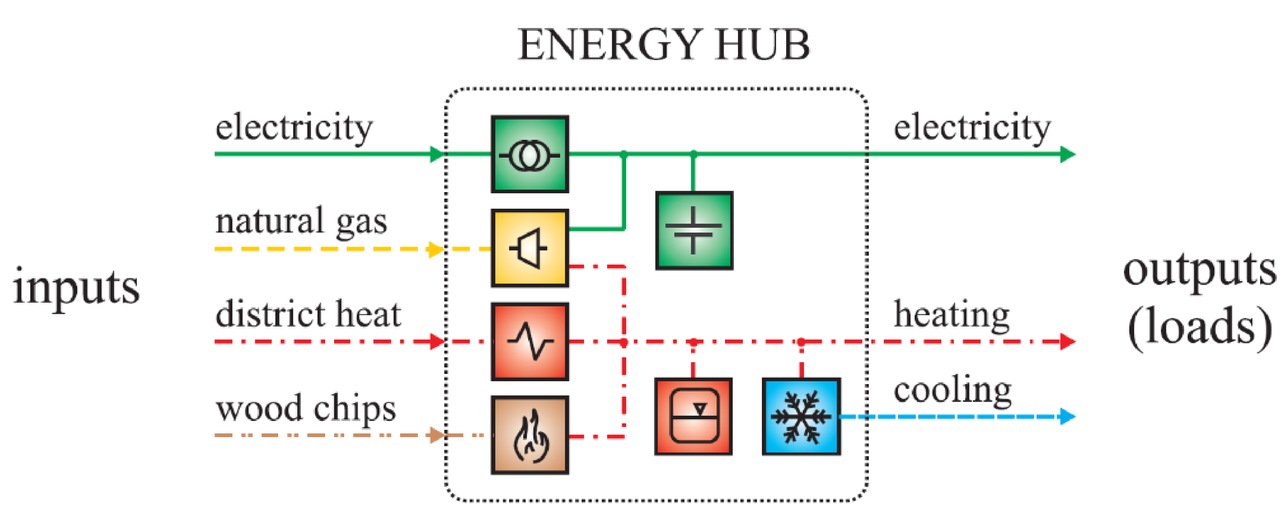
with $\mathcal{N} = \{0, 1, \ldots, N-1\}$ and stage costs defined by

$$l_k(x_k, u_k) = \frac{1}{2} \begin{bmatrix} x_k \\ u_k \end{bmatrix}' \begin{bmatrix} Q_k & M_k' \\ M_k & R_k \end{bmatrix} \begin{bmatrix} x_k \\ u_k \end{bmatrix} + \begin{bmatrix} q_k \\ s_k \end{bmatrix}' \begin{bmatrix} x_k \\ u_k \end{bmatrix} + \rho_k$$

$$l_N(x_N) = \frac{1}{2} x_N' P_N x_N + p_N' x_N + \gamma_N$$

The Extended Linear Quadratic Control Problem is an extension of the standard Linear Quadratic Control Problem. The Extended Linear Quadratic Control Problem is the computational workhorse for linear model predictive control as well as nonlinear model predictive control; it is the subproblem arising in interior-point as well as active-set quadratic programming algorithms for constrained optimal control problems. These algorithms can be used for embedded MPC of individual energy units.

Integration of Scheduling and Control



Test on the Energy System of the Faroe Islands