Dodik Alhajjar
Johannes Predel
Eric Rockstädt
Theodor Schönfisch

DCLF Model Formulation 01

EW-Mod
August 31, 2020

1 Variables

1. $G_{p,t}$ – Conventional generation of each plant
2. $INJ_{n,t}$ – Injection at each node
3. $Gr_{n,t}$ – Renewable generation at each node
4. $D_{s,t}$ – Energy input into each storage
5. $Gs_{s,t}$ – Generation of each storage
6. $L_{s,t}$ – Energy level of each storage

2 Sets

1. T – Timesteps
2. $PLANTS$ – plants
3. $Disp \subset PLANTS$ – Dispatchable plants
4. $NODES$ – Nodes
5. $STORAGES$ – Storages
6. $LINES$ – transmission lines

3 Parameters

1. mc – Marginal costs of dispatchable plants
2. mcs – Marginal cost of storages
3. $gmax_c$ – Generation max of dispatchable plants
4. $gmax_r$ – Generation max of renewables
5. $gmax_s$ – Storage Max
6. $ptdf$ – Power transfer distribution factor matrix
7. $lmax$ – Transmission line capacity
8. $demand$ – Demand at each node

4 Equations

$$min(\sum_{d \in disp, t \in T} mc_d \cdot G_{d,t} + \sum_{s \in STORAGES, t \in T} mc_s \cdot Gs_{s,t}) \tag{1}$$

s.t.

$$G_{p,t} \leq gmaxc_p \tag{2}$$
$$\forall p \in PLANTS, t \in T$$

$$Gr_{n,t} \leq gmaxr_{n,t} \tag{3}$$
$$\forall n \in NODES, t \in T$$

$$G_{n,p,t} - demand_{n,t} + Gr_{n,t} - D_{n,s,t} + Gs_{n,s,t} = INJ_{n,t} \tag{4}$$
$$\forall n \in NODES, t \in T, p \in PLANTS, s \in STORAGES$$

$$D_{s,t} \leq gmax_s \tag{5}$$
$$\forall s \in STORAGES, t \in T$$

$$Gs_{s,t} \leq gmax_s \tag{6}$$
$$\forall s \in STORAGES, t \in T$$

$$L_{s,t} \leq gmax_s \tag{7}$$
$$\forall s \in STORAGES, t \in T$$

$$L_{s,t+1} = L_{s,t} - Gs_{s,t} + D_{s,t} \tag{8}$$
$$\forall s \in STORAGES, t \in T$$

$$L_{s,1} = gmax_s \tag{9}$$
$$\forall s \in STORAGES$$

$$\sum_{n \in NODES, t \in T} ptdf_{l,n} \cdot INJ_{n,t} \leq lmax_l \tag{10}$$
$$\forall l \in LINES$$

$$\sum_{n \in NODES, t \in T} ptdf_{l,n} \cdot INJ_{n,t} \geq -lmax_l \tag{11}$$

$$\forall l \in LINES$$

$$\sum_{n} INJ_{n,t} = 0 \tag{12}$$

$$\forall t \in T$$

5 Explanation

Net Transfer with European Neighbors so far is not in the model. Efficiency for Storage should be added.

6 Feedback/To Do