Main.mod

set INFRASTRUCTURE; # Infrastructure: DHN, grid, and intermediate energy conversion technologies (i.e. not directly supplying end-use demand)

set TECHNOLOGIES := (setof {i in END\_USES\_TYPES, j in TECHNOLOGIES\_OF\_END\_USES\_TYPE [i]} j) union STORAGE\_TECH union INFRASTRUCTURE union TECHNOLOGIES\_OF\_CCUS union TECHNOLOGIES\_OF\_IND union TECHNOLOGIES\_OF\_PRIVATEMOB\_ALL\_DISTANCES;

## Grid infrastructure sets

set ELECTRICITY\_LAYERS within LAYERS;

set NG\_LAYERS within LAYERS;

set H2\_LAYERS within LAYERS;

set GRIDS\_OF\_LAYERS{ELECTRICITY\_LAYERS union NG\_LAYERS union H2\_LAYERS};

set GRIDS;

# Printing sets

set INFRASTRUCTURE\_ELEC\_GRID;

set INFRASTRUCTURE\_GAS\_GRID;

set INFRASTRUCTURE\_ELEC\_STORAGE;

set INFRASTRUCTURE\_GAS\_STORAGE;

# variables of INFRASTRUCTURE

var C\_inv\_grid\_help{GRIDS} >= 0;

data.dat

set INFRASTRUCTURE := NG\_REFORMING DIE\_STO STO\_DIE GASO\_STO STO\_GASO ELEC\_STO STO\_ELEC H2\_STO STO\_H2 CO2\_STO STO\_CO2 NG\_STO STO\_NG SNG\_NG EFFICIENCY METHANATION DHN GRID GASIFICATION\_SNG PYROLYSIS AN\_DIG HYDRO\_GAS AN\_DIG\_SI FT BIOMASS\_ETHANOL METHANOL\_TO\_AROMATICS METHANOL\_TO\_OLEFINS CO2-To-Diesel ALKALINE\_ELECTROLYSIS PEM\_ELECTROLYSIS SOEC\_ELECTROLYSIS ETHANE\_CRACKING METATHESIS\_PROPYLENE SMART\_PROCESS CROPS\_TO\_JETFUELS CO2\_TO\_JETFUELS LT\_DEC\_WH LT\_DHN\_WH HT\_LT HT\_LT\_DEC BIOGAS\_BIOMETHANE CROPS\_TO\_ETHANOL ETHANE\_TO\_ETHYLENE ETHANOL\_TO\_JETFUELS GASIFICATION\_H2 OTHER\_BIOMASS BATTERY

EHV\_GRID HV\_GRID MV\_GRID LV\_GRID

TRAFO\_EH TRAFO\_HE

TRAFO\_HM TRAFO\_MH

TRAFO\_ML TRAFO\_LM

EHP\_H2\_GRID HP\_H2\_GRID MP\_H2\_GRID LP\_H2\_GRID

EHP\_NG\_GRID HP\_NG\_GRID MP\_NG\_GRID LP\_NG\_GRID

NG\_EXP\_EH NG\_EXP\_HM NG\_EXP\_ML NG\_EXP\_EH\_COGEN NG\_EXP\_HM\_COGEN NG\_EXP\_ML\_COGEN

NG\_COMP\_HE NG\_COMP\_MH NG\_COMP\_LM

H2\_EXP\_EH H2\_EXP\_HM H2\_EXP\_ML H2\_EXP\_EH\_COGEN H2\_EXP\_HM\_COGEN H2\_EXP\_ML\_COGEN

H2\_COMP\_HE H2\_COMP\_MH H2\_COMP\_LM

;

set INFRASTRUCTURE\_GAS\_GRID := EHP\_H2\_GRID HP\_H2\_GRID MP\_H2\_GRID LP\_H2\_GRID

EHP\_NG\_GRID HP\_NG\_GRID MP\_NG\_GRID LP\_NG\_GRID

NG\_EXP\_EH NG\_EXP\_HM NG\_EXP\_ML NG\_EXP\_EH\_COGEN NG\_EXP\_HM\_COGEN NG\_EXP\_ML\_COGEN

NG\_COMP\_HE NG\_COMP\_MH NG\_COMP\_LM

H2\_EXP\_EH H2\_EXP\_HM H2\_EXP\_ML H2\_EXP\_EH\_COGEN H2\_EXP\_HM\_COGEN H2\_EXP\_ML\_COGEN

H2\_COMP\_HE H2\_COMP\_MH H2\_COMP\_LM

;

set INFRASTRUCTURE\_ELEC\_GRID := EHV\_GRID HV\_GRID MV\_GRID LV\_GRID

TRAFO\_EH TRAFO\_HE

TRAFO\_HM TRAFO\_MH

TRAFO\_ML TRAFO\_LM

;

set INFRASTRUCTURE\_GAS\_STORAGE := NG\_STO STO\_NG H2\_STO STO\_H2;

set INFRASTRUCTURE\_ELEC\_STORAGE := ELEC\_STO STO\_ELEC HYDRO\_STORAGE;

set TECHNOLOGIES\_OF\_IND:=CEMENT;

set GRIDS\_OF\_LAYERS['ELECTRICITY\_EHV'] := EHV\_GRID;

set GRIDS\_OF\_LAYERS['ELECTRICITY\_HV'] := HV\_GRID;

set GRIDS\_OF\_LAYERS['ELECTRICITY\_MV'] := MV\_GRID;

set GRIDS\_OF\_LAYERS['ELECTRICITY\_LV'] := LV\_GRID;

set GRIDS\_OF\_LAYERS['H2\_EHP'] := EHP\_H2\_GRID;

set GRIDS\_OF\_LAYERS['H2\_HP'] := HP\_H2\_GRID;

set GRIDS\_OF\_LAYERS['H2\_MP'] := MP\_H2\_GRID;

set GRIDS\_OF\_LAYERS['H2\_LP'] := LP\_H2\_GRID;

set GRIDS\_OF\_LAYERS['NG\_EHP'] := EHP\_NG\_GRID;

set GRIDS\_OF\_LAYERS['NG\_HP'] := HP\_NG\_GRID;

set GRIDS\_OF\_LAYERS['NG\_MP'] := MP\_NG\_GRID;

set GRIDS\_OF\_LAYERS['NG\_LP'] := LP\_NG\_GRID;

set GRIDS :=

EHV\_GRID HV\_GRID MV\_GRID LV\_GRID

EHP\_H2\_GRID HP\_H2\_GRID MP\_H2\_GRID LP\_H2\_GRID

EHP\_NG\_GRID HP\_NG\_GRID MP\_NG\_GRID LP\_NG\_GRID

;

param: l\_grid\_ext :=

LV\_GRID 130000

MV\_GRID 43000

HV\_GRID 8900

EHV\_GRID 6700

LP\_H2\_GRID 9700

MP\_H2\_GRID 4350

HP\_H2\_GRID 940

EHP\_H2\_GRID 710

LP\_NG\_GRID 9700

MP\_NG\_GRID 4350

HP\_NG\_GRID 940

EHP\_NG\_GRID 710

;

param n\_stations :=

LV\_GRID 2.2e6

MV\_GRID 15490

HV\_GRID 775

EHV\_GRID 137

LP\_H2\_GRID 0.44e6

MP\_H2\_GRID 2039

HP\_H2\_GRID 116

EHP\_H2\_GRID 20

LP\_NG\_GRID 0.44e6

MP\_NG\_GRID 2039

HP\_NG\_GRID 116

EHP\_NG\_GRID 20

;

param f\_grid\_ext :=

EHP\_NG\_GRID 8.83844

EHV\_GRID 6.29658

HP\_NG\_GRID 8.83844

HV\_GRID 8.66837

LP\_NG\_GRID 7.03571

LV\_GRID 4.14995

MP\_NG\_GRID 8.87611

MV\_GRID 5.57394

LP\_H2\_GRID 0

MP\_H2\_GRID 0

HP\_H2\_GRID 0

EHP\_H2\_GRID 0

;

param k\_security :=

LV\_GRID 6

MV\_GRID 6

HV\_GRID 6

EHV\_GRID 6

LP\_H2\_GRID 6

MP\_H2\_GRID 6

HP\_H2\_GRID 6

EHP\_H2\_GRID 6

LP\_NG\_GRID 6

MP\_NG\_GRID 6

HP\_NG\_GRID 6

EHP\_NG\_GRID 6

;

let loss\_coeff['ELECTRICITY\_EHV'] := 0.008\*48.9 ; #

let loss\_coeff['ELECTRICITY\_HV'] := 0.016\*11.5 ; #

let loss\_coeff['ELECTRICITY\_MV'] := 0.033\*2.8 ; #

let loss\_coeff['ELECTRICITY\_LV'] := 0.102\*0.06 ; #

let loss\_coeff['HEAT\_LOW\_T\_DHN'] := 0.05 ; #

let layers\_in\_out['NG\_EHP','NG\_EHP'] := 1 ; #

let layers\_in\_out['NG\_HP','NG\_HP'] := 1 ; #

let layers\_in\_out['NG\_MP','NG\_MP'] := 1 ; #

let layers\_in\_out['NG\_LP','NG\_LP'] := 1 ; #