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LIST OF ABBREVIATIONS

MES	= multi-energy system
RE	= renewable energy
PDP	= power development plans
HS	= hydrogen storage
AEDP	= alternative energy development plan
EH	= energy hub
TOC	= total operating costs
EP	= electricity peak from the grid
TCE	= total carbon emissions
OMES-WSPHS	= optimal scheduling of multi-energy systems with wind-solar power and hydrogen storage
NG	= natural gas
PSO	= particle swarm optimization
LP	= linear programming
PSO-LP	= hybrid particle swarm optimization and linear programming
MES-WSPHS	= multi-energy system with wind-solar power and hydrogen storage
MES-WSP	= multi-energy system with wind-solar power
FMOO	= fuzzy multi-objective optimization
MCS	= Monte Carlo simulation
WTs	= wind turbines
PVPs	= photovoltaic panels
PDF	= probabilistic density function
GA	= genetic algorithm
MIP	= mixed integer programming
GAMS	= general algebraic modeling system
EA	= evolutionary algorithm
CPLEX	= C programming language for mathematical programming execution

LIST OF ABBREVIATIONS (Continued)

MINLP	= mixed-integer non-linear programming
GA-PSO	= hybrid genetic algorithm and par
PtG	= power-to-gas
WSMO	= weight sum multi-objective optimization
CHP	= combined heat and power
MOPSO	= multi-objective particle swarm optimization
TOU	= time of use
SAUGMECON	= stepwise augmented ϵ -constraint method
VIKOR	= VlseKriterijumska Optimizacija i Kompromisno Resenje
RO	= robust optimization
BESS	= battery energy storage system
ESS	= energy storage system
PV	= photovoltaic
EL	= electrolyzer
FC	= fuel cell
RTP	= real-time pricing
TR	= transformer
GB	= gas boiler
MT	= micro-turbine
DC	= direct current
AC	= alternative current
SOT	= state of the tank
FSMF	= fuzzy-satisfaction membership function
TGO	= Thailand greenhouse gas management organization
OBJ	= objective function
SD	= standard deviation
THB	= Thai baht

LIST OF NOMENCLATURE

Variable

P	= The matrix contains a scheduling variable.
η	= Efficiency (%).
P	= The power inputs or the power flow through the device (kW).
L	= The power outputs or power demands (kW).
NT	= The total number of wind turbines.
v	= The velocity (m/s).
Y	= The parameter indicates the operation state.
C	= The cost of the energy input (THB/kWh).
PNF	= The penalty functions.
ρ	= The penalty factor.
LHV	= The low heat value (MJ/kmol).
$\Re$	= The gas constant (J/mol·K).
T	= The mean temperature (K).
V	= The volume (m ³).
p	= The pressure (bar).
n	= The molar flow (mol/s).
h	= The times (hour).
z	= The height (m).
α	= The power law exponent.
A	= Area of PVPs installed (m ²).
β	= PVPs efficiency (%).
SI	= Solar irradiance (W/m ²).
w	= Inertia weight.
c	= Learning factor.

LIST OF NOMENCLATURE (Continued)

<i>rand</i>	= A random number between 0 and 1.
<i>pbest</i>	= personal best.
<i>gbest</i>	= global best.
<i>initial</i>	= initial setting value.
μ	= The satisfactory membership function.
<i>a</i>	= Shape.
<i>b</i>	= Scale.
<i>f</i>	= The probability density function.
σ	= The standard deviation of the normal distribution.
<i>M</i>	= The mean value of the normal distribution.
<i>SOT</i>	= The state of the tank (%).
<i>TOC</i>	= The total operating costs (THB).
<i>TCE</i>	= The total carbon emissions (kg/CO ₂).
<i>EP</i>	= The electricity peak from the grid (kW).

Subscript and Superscript

1	= The number which indicates the order.
2	= The number which indicates the order.
<i>E</i>	= Electricity.
<i>H</i>	= Heat.
<i>NG</i>	= Natural gas.
<i>H₂</i>	= Hydrogen.
<i>EL</i>	= Electrolyzer.
<i>FC</i>	= Fuel cell.
<i>MT</i>	= Micro-turbine.
<i>TR</i>	= Transformer.

LIST OF NOMENCLATURE (Continued)

<i>GB</i>	= Gas boiler.
<i>L</i>	= The power outputs or power demands.
<i>WSP</i>	= Wind-solar power.
<i>AC / DC</i>	= AC-to-DC converter.
<i>DC / AC</i>	= DC-to-AC converter.
<i>r</i>	= Reference.
<i>WTs</i>	= Wind turbines.
<i>SI</i>	= Solar irradiance.
<i>i</i>	= Power injected into the grid.
<i>ex</i>	= The excess power.
<i>PVPs</i>	= Photovoltaic panels.
<i>tank</i>	= The storage of hydrogen.
<i>rated</i>	= The maximum limit.
<i>min</i>	= The minimum limit.
<i>T</i>	= Total.