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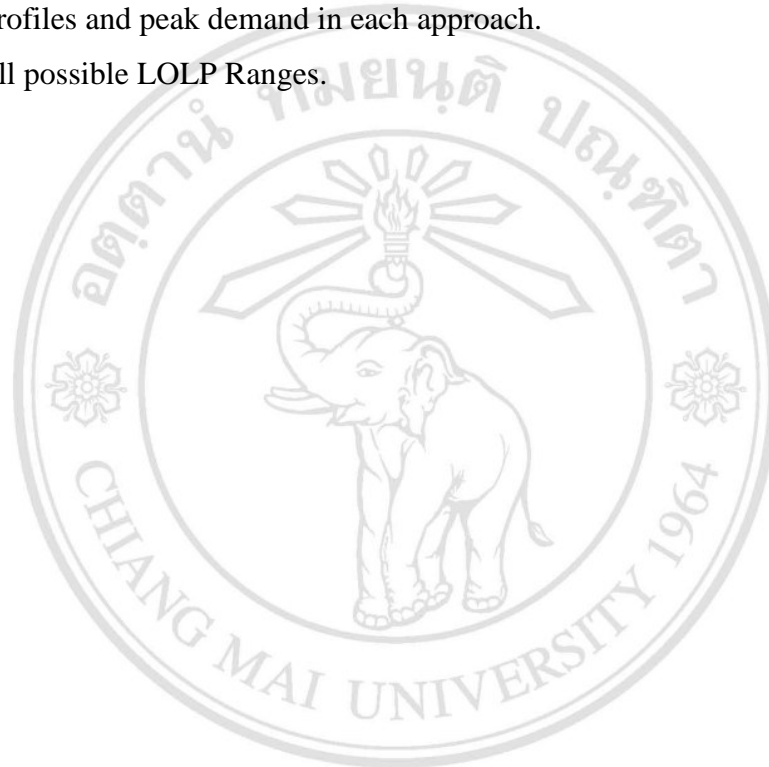
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## LIST OF ABBREVIATIONS

CC	Capacity Credit
CF	Capacity Factor
COPT	Capacity Outage Probability Table
EC	Effective Capacity
ECPP	Equivalent Conventional Power Plant
EENS	Expected Energy Not Supplied
EFC	Equivalent Firm Capacity
EFOR	Equivalent Forced Outage Rate
ELCC	Effective Load Carrying Capability
ELDC	Equivalent Load Duration Curve
FOH	Forced Outage Hour
FOR	Force Outage Rate
GC	Guaranteed Capacity
ILDC	Inverted Load Duration Curve
LDC	Load Duration Curve
LOLE	Loss of Load Expectation
LOLP	Loss of Load Probability
LPT	Load Probability Table
MTTF	Mean Time to Failure
MTTR	Mean Time to Repair
PV	Photovoltaic
SH	Service Hour
STC	Standard Test Condition

## LIST OF SYMBOLS

$\eta_C$	Cell efficiency
$\eta_G$	Generator efficiency
$\eta_I$	Inverter efficiency
$\eta_T$	Turbine efficiency
$\eta_{TH}$	Thermal efficiency of a power plant
$\lambda$	Expected failure rate
$\mu$	Expected repair rate
$v$	Wind speed
$v_I$	Cut-in wind speed
$v_O$	Cut-out wind speed
$v_R$	Rated wind speed
$\rho_A$	Air density
$\rho_W$	Water density
$\mathcal{G}$	Cell temperature
$\mathcal{G}_{STC}$	Cell temperature at standard test condition
$A$	Unit availability
$A_p$	Panel area
$A_S$	Swept area of the rotor
$AM_{STC}$	Air mass at standard test condition
$C$	Generation capacity of unit
$C_i$	Capacity outage of state $i$ for the unit being added
$C_p$	Performance coefficient of wind turbine
${}^nC_{nr}$	Number of combination of $nr$ items from $n$ items
$CK$	Installed capacity of the benchmark unit
$D$	Power demand
$E_k$	Energy curtailed of the $k$ -th outage

$EC_I$	Effective capacity (Definition I)
$EC_{II}$	Effective capacity (Definition II)
$EL$	Equivalent load
$f$	Cycle frequency
$F$	Feed rate
$F(\bullet)$	Old cumulative distribution of load level
$F'(\bullet)$	New cumulative distribution of load level
$FF$	Fill factor
$g$	Gravitational acceleration
$G_{BG}$	Output power of biogas unit
$G_{BM}$	Output power of biomass unit
$G_H$	Output power of small hydro unit
$G_{PV}$	Output power of PV panel
$G_W$	Output power of wind turbine
$G_W^{rated}$	Rated power of wind turbine
$H$	Water head
$I_r$	Solar irradiance density
$I_{SC}$	Short circuit current
$I_{r,STC}$	Solar irradiance density at standard test condition
$m$	Mean time to failure (MTTF)
$n$	Number of unit states
$O_k$	Magnitude of the $k$ -th outage in the system
$p_i$	Probability of existence of the unit state $i$
$p_k$	Probability of a capacity outage of magnitude
$P_{nr}$	Probability of $nr$ units in the down state
$P_{MPP}$	Power at maximum power point
$P(X)$	Cumulative probability of capacity outage state of $X$ MW after the unit is added.
$P'(X)$	Cumulative probability of capacity outage state of $X$ MW before the unit is added.
$Q$	Water flow rate
$r$	Mean time to repair (MTTR)

$R$	Risk of power deficit
$RK$	Installed capacity of the unit of interest
$S$	System capacity
$T$	Cycle time
$U$	Unit unavailability, FOR
$V$	Heating value of fuel
$V_{OC}$	Open circuit voltage
$X$	Capacity outage state
$X$	Equivalent load of all units except unit of interest which has the same risk of power deficit (Only in Chapter 4)
$X1$	Capacity level that will be exceeded with $R$ of ELDC of all units.
$X2$	Capacity level that will be exceeded with $R$ of ELDC of all units except unit of interest.

### Subscripts

$i$	Unit state
$j$	Index of Unit
$k$	The order of outage in the system
$l$	Index of discretized capacity available in generation system
$N$	Number of identical units
$nr$	Number of units in the failed state
IA	Approach IA
IB	Approach IB
IC	Approach IC

### Superscripts

$N$	Number of units
-----	-----------------

## ข้อความแห่งการริเริ่ม

- 1) แบบจำลองผลิตไฟฟ้าของแหล่งพลังงานหมุนเวียนถูกนำเสนอเพื่อใช้ในการประเมินความเชื่อถือได้ของการผลิตไฟฟ้าและการวางแผนผลิตไฟฟ้า
- 2) วิธีการประเมินค่าถูกกำหนดเพื่อหาสัดส่วนผลิตไฟฟ้าที่เหมาะสมของแหล่งพลังงานหมุนเวียนในระบบผลิตไฟฟ้า
- 3) เกณฑ์ความเชื่อถือได้และการวางแผนผลิตไฟฟ้าได้รับการทบทวนเมื่อมีแหล่งพลังงานหมุนเวียนรวมอยู่อย่างมีนัยสำคัญ

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## STATEMENTS OF ORIGINALITY

- 1) The generation models of renewable energy resources are proposed for using in generation reliability assessment and generation planning.
- 2) Evaluation method is proposed to determine proper penetration level of renewable energy resources in generation system.
- 3) The generation reliability and planning criteria are reviewed under the significant presence of renewable energy resources.



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