LIST OF CONTENT

Chapter Page

LIST OF CONTENT (CONT.)

Chapter Page

LIST OF CONTENT (CONT.)

Chapter Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

LIST OF FIGURES (CONT.)

Figure Page

LIST OF FIGURES (CONT.)

Figure Page

ABBREVIATIONS

BSPP	Biomass-hybrid Solar Thermal Power Plant
CPS	Central Power Station
CSP	Concentrating Solar Power
DISS	Direct Solar Steam
DSG	Direct Steam Generation
EGAT	Electricity Generating Authority of Thailand
EPC	Energy Park Collector
HTF	Heat Transfer Fluid
IPP	Independent Power Producer
LEC	Levelized Electricity Cost
MEA	Metropolitan Electricity Authority
NU	Naresuan University
PCU	Power Conversion Unit
PEA	Provincial Electricity Authority
PSA	Plataforma Solar de Almeria
PTC	Parabolic Trough Collector
SEGS	Solar Electricity Generating System
SERT	School of Renewable Energy Technology
SM	Solar Multiple
SPP	Small Power Producer
TES	Thermal Energy Storage

ABBREVIATIONS (CONT.)

A_a	Collector aperture area
A_r	Surface area of absorber
A_c	Surface area of glass cover
C_g	Geometric concentration ratio
C_p	Specific heat of fluid
$C_{th,\ min}$	Minimum thermal storage capacity, in hours
D_c	Glass cover diameter
D_i	Absorber inside diameter
D_o	Absorber outside diameter
F_B	Boiler heat removal factor
F_R	Collector heat removal factor
G_{bc}	Clear sky normal beam irradiance on a horizontal surface
HHV_{gas}	High heating value of producer gas
H_i , H_o	Specific enthalpies of fluid at collector inlet & outlet
$\bar{H}$	Monthly average daily global radiation of Phitsanulok
h_f	Heat transfer coefficient inside the absorber
$h_{rad,\ r\text{-}c}$	Radiation heat loss from absorber wall to glass cover
$h_{conv,\ r\text{-}c}$	Convection heat loss from absorber wall to glass cover
$h_{rad,\ c\text{-}a}$	Radiation heat loss from glass cover to the sky
h_{wind}	Convection heat loss to the ambient
I_a	Direct normal irradiance
k	Thermal conductivity of absorber
k_{air}	Thermal conductivity of air
$\bar{K}_T$	Average clearness index
K_θ	Incidence angle modifier

ABBREVIATIONS (CONT.)

L_r	Aperture (or receiver) length
m_{fuel}	Mass of solid biomass fuel
m_{st}	Mass of the storage medium
$(mC_p)_{st}$	Mass-specific heat product of the storage medium
$\dot{m}$	Mass flux of fluid
$\dot{m}_L$	Mass flux of the load stream
$\dot{m}_s$	Mass flux of steam
N_u	Nusselt number
n	Day of the year
Pr	Prandlt number
P_{in}	Process pressure at collector inlet
P_{rated}	Rated power of the electric generator
Q_A	Energy addition to the boiler of PCU
Q_L	Energy removal to the PCU
Q_u	Useful gain of collector
$Q_{u,bio}$	Useful energy from gasifier
R_e	Reynolds number
r_d	Ratio of hourly total to daily total diffuse radiation
r_t	Ratio of hourly total to daily total global radiation
S	Absorbed radiation per unit aperture area
T_{amb}	Ambient temperature
T_{bi} , T_{bo}	Fluid temperature at boiler inlet & outlet
T_{fi} , T_{fo}	Fluid temperature at collector inlet & outlet
T_c	Temperature of glass cover

ABBREVIATIONS (CONT.)

T_r	Temperature of absorber wall
T_{sat}	Saturation temperature of water at P_{in}
$T_{st,\ initial}$	Initial temperature of storage medium
T_{st}	Temperature of storage medium at the start of each finite time-interval
T^{*}_{st}	Temperature of storage medium at the end of each finite time-interval
T_1 , P_1	Temperature & pressure of vapor (steam) at inlet of expander (engine)
T_2 , P_2	Temperature & pressure of mixture at outlet of expander (engine)
T_3 , P_3	Temperature & pressure of fluid (water) at outlet of condenser
UA_B	Overall heat transfer coefficient in the boiler heat exchanger
U_L	Overall heat loss coefficient
U_o	Overall heat transfer coefficient
$(UA)_{st}$	Loss coefficient – area product of storage tank
V_{air}	Velocity of air (wind speed)
W	Aperture width
$W - D_o$	Effective aperture
Y_{gas}	Yield of gas, in terms of m^3 per kg of solid fuel

ABBREVIATIONS (CONT.)

η_{aux}	Efficiency of combustion
η_{cycle}	Thermal efficiency of the Rankine cycle
η_E	Efficiency of expander (engine)
$\eta_{gasifier}$	Efficiency of gasifier
η_{gen}	Efficiency of electric generator
η_i	Instantaneous thermal efficiency of collector
η_o	Optical efficiency of collector
η_{pcu}	Efficiency of PCU
η_{total}	Overall solar-to-electric efficiency
$cos\,\theta$	Cosine of the incidence angle
$cos\,\theta_z$	Cosine of the zenith angle
$cos\,\omega_s$	Cosine of the sunset hour angle
δ	Declination angle
ψ	Latitude of Phitsanulok
λ	Altitude of Phitsanulok
α	Absorptance of absorber
ε_r	Emittance of absorber
τ	Transmittance of glass cover
ε_c	Emittance of glass cover
ρ	Specular reflectance
γ	Intercept factor
μ_{air}	Kinematic viscosity of air
μ_w	Kinematic viscosity of water