Nomenclature

B	width of collector channel (m)
BIS	built-in-storage
Cal	calculation
Conv.	conventional
C_{pf}	specific heat of water in the collector channel (kJ/kgK)
C_{pf}^{t}	specific heat of water in the collector channel at time t (kJ/kgK)
C_{ps}	specific heat of water in the storage tank (kJ/kgK)
C_{ps}^{t}	specific heat of water in the storage tank at the time t (kJ/kgK)
d	collector channel depth (m)
Exp	experiment
Gr_e	Grashoft number
G_T	total solar energy falling on the collector (kJ/m^2)
g	gravitational constant (m/s^2)
H	storage tank depth (m)
h	vertical height (m)
h_f	convective heat transfer coefficient between the absorber and water in the channel (W/m^{2}K)
h_f^t	convection heat transfer coefficient between the absorber and water in the channel at time t (W/m^{2}K)
h_v	wind heat transfer coefficient
I_T	total solar irradiance falling on the collector surface (W/m^2)
I_T^t	total solar irradiance falling on the collector surface at time t (W/m^2)
K_f	the overall flow coefficient due to the friction along the water flow passage through distributor, inlet and outlet hole of the collector channel and check valve (kg s^{-1}{m K}$^{-1/2}$)
k_{of}	heat conductivity of the wall insulation partition (W/mK)
k_{os}	heat conductivity of tank wall insulation (W/mK)
k_{sf}	heat conductivity of the insulated partition (W/mK)

k_w	thermal conductivity of water (W/mK)
L	collector length (m)
l_{of}	thickness of the wall insulation (m)
l_{os}	thickness of tank wall insulation (m)
l_{sf}	thickness of the insulated partition (m)
M_s	mass capacity of water in storage tank (kg)
$\dot{m}$	mass flow rate of water flowing through the system (kg/s)
$\dot{m}^t$	mass flow rate of water flowing through the system at time t (kg/s)
N	number of glass cover
$\overline{Nu_e}$	average Nusselt number
$\mathrm{Pr_e}$	Plandtl number
Q_A	absorbed total solar radiation on the absorber plate (W/m^2)
Q_c	total energy stored in the water in the collector channel at any instant (W/m^2)
$Q_{c\text{-}a}$	energy loss from the collector channel to the ambient air (W/m^2)
$Q_{c\text{-}s}$	energy transfer between water in the collector channel and the storage tank by passing through the insulated partition (W/m^2)
$Q_{p\text{-}c}$	total heat transfer from the absorber plate to the water in collector channel (W/m^2)
Q_s	total energy stored in the water in the storage at any instant (W/m^2)
$Q_{s\text{-}a}$	energy loss from the storage to the ambient air (W/m^2)
Q_{TL}	total heat losses from the top of the absorber plate to the ambient air (W/m^2)
Q_u	useful energy in the water flowing out from the collector channel (W/m^2)
T_1	average water temperature in the storage tank at sunrise (°C)
T_2	average water temperature in the storage tank at sunset (°C)
T_3	average water temperature in the storage tank before sunrise of the next morning (°C)
T_a	ambient temperature (°C)
T_a^*	absolute ambient temperature (K)
T_a^t	ambient temperature at time t (°C)

$T_{a,night}$	average ambient temperature during the night (°C)
$T_{a,morning}$	ambient temperature at the same time of T_3 (°C)
T_f	water temperature in the collector channel (°C)
T_f^t	water temperature in the collector channel at time t (°C)
$T_f^{t+\Delta t}$	water temperature in the collector channel at time $t+\Delta t$ (°C)
T_{fb}	temperature of the water at the bottom of the collector channel (°C)
T_{fm}	average temperature of the water in the collector channel (°C)
T_{ft}	temperature of the water at the top of the collector channel (°C)
T_{mb}	average temperature of the water at the bottom, $(T_{sb}+T_{fb})/2$, (°C)
T_{mt}	average temperature of the water at the top, $(T_{ft}+T_{st})/2$, (°C)
T_p	average temperature of the absorber plate (°C)
T_p^*	absolute absorber plate temperature (K)
T_s	water temperature in the storage tank (°C)
T_s^t	water temperature in the storage tank at time t (°C)
$T_s^{t+\Delta t}$	water temperature in the storage tank at time $t + \Delta t$ (°C)
T_{sb}	temperature of the water at the bottom of the storage (°C)
T_{sm}	average temperature of the water in the storage tank (°C),
$T_{s,\max}$	maximum average water temperature in the storage tank (°C)
T_{st}	temperature of the water at the top of the storage (°C)
U_{of}	heat losses coefficient from water in the collector channel through the side insulation wall to the ambient air (W/m^2K)
U_{os}	heat loss coefficient between the storage tank and ambient (W/m^2K)
U_{sf}	heat transfer coefficient between water in the channel and the storage tank (W/m^2K)
U_t	overall top loss coefficient between the absorber plate and ambient temperature taken into account the effect of glass cover (W/m^2K)
U_t^t	overall top loss coefficient between the absorber plate and ambient temperature taken into account the effect of glass cover at time t (W/m^2K)

V	velocity of water flow (m/s)
v_{wind}	wind speed across the front cover of the collector (m/s)
Δy	length of the portion (m)
θ	inclination angle
τ_g	transmittance of glass cover
α_p	absorptance of absorber plate
$(\tau\alpha)_e$	effective transmittance-absorptance product of the collector
ε_g	emittance of glass cover
ε_p	emittance of absorber plate
σ	Stefan-Boltzmann constant (5.6697×10^{-8} W/m^{2}K^4),
ρ	density of water (kg/m^3)
β	thermal expansion coefficient of water (K^{-1})
μ	viscosity of water (kg/m-s)
ρ_f	density of the water in the collector channel (kg/m^3)
ρ_f^t	density of the water in the collector channel at time t (kg/m^3)
ρ_s	density of the water in the storage tank (kg/m^3)
ρ_s^t	density of water in of storage tank at time t (kg/m^3)