















*Conference on Management and Industrial Engineering*, Bucharest 7, pp. 729-740.

- [23] Tereshchenko T., Nord N. (2016). Energy planning of district heating for future building stock based on renewable energies and increasing supply flexibility – *Energy*, Vol. 112, pp. 1227-1244.
- [24] Delmastro C., Mutani G., Schranz L. (2015). Advantages of coupling a woody biomass cogeneration plant with a district heating network for a sustainable built environment: a case study in Luserna San Giovanni, *Energy Procedia*, Vol. 78, pp. 794–799.
- [25] Sartor K., Quoilin S., Dewallef P. (2014). Simulation and optimization of a CHP biomass plant and district heating network, *Applied Energy*, Vol. 130, pp. 474–483.
- [26] Quattordio Combined Heat and Power Plant – Final Project Documents – Autorizzazione Unica n. DDAP1-407/2012 (Italian).

Pt	thermal power, kW
Pt'	thermal power per unit length, W. m-1
SecD	DH network main section length, m
SecL	DH network branch length, m
T	Tariff (thermal or electrical), €. MWh-1
T	Temperature, °C
TC	tax credit, €. MWh-1
v	carrier fluid speed, m. s-1

### Greek symbols

$\delta$	dimensionless binary decisional variable defining thermal users and fluids
$\phi$	diameter, mm
$\pi$	dimensionless Greek pi number
$\rho$	density, kg. m-3
$\tau$	dimensionless binary decisional variable defining the steam turbine

### NOMENCLATURE

a	dimensionless parameter defining the DH network
CASH	Cash Flow term, €
Coeff1	quadratic curve coefficient 1 for the electric power calculation, kW-1
Coeff2	quadratic curve coefficient 1 for the electric power calculation, dimensionless
Coeff3	quadratic curve coefficient 1 for the electric power calculation, kW
cold	dimensionless binary decisional variable defining cooling energy request
COP	Coefficient of Performance
cu	DH cost per unit length of pipe, €. m-1
dmax	maximum value of subscript d
Ee	electric energy, MWh
EQU	Equity Funding term, €
Et	thermal energy, MWh
fmax	maximum value of subscript f
imax	maximum value of subscript i
h	enthalpy, kJ. kg-1. °C-1
h	number of hours of the period, h
IRR	Internal Rate of Return, dimensionless
K	dimensionless auxiliary parameter
Lcum	cumulative length, m
N	Net Cash Flow term
NPV	Net Present Value, €
p	Pressure, bar
Pe	electrical power, kW
PES	Primary Energy Saving
Pf	cooling power, kW

### Subscripts

base	base electrical tariff
BIO	biomass steam thermal cycle
CAR	High Efficiency CHP regulation
d	main section of DH network
D	daily, related to the year subdivision
DEL	delivery, related to the DH pipes
DH	District Heating
el	electric
f	fluid
FIN	related to financial activities
fix	fix value
GAS	natural gas
GRO	gross, related to electrical production
STO	stop, related to biomass cycle stops
i	thermal user
LOSS	related to thermal losses
m	period
MAX	maximum value
n	net value (thermal tariff)
NET	net, related to related to electrical production
OPE	related to operating activities
pr1	electric energy prize 1
pr2	electric energy prize 2
pr3	electric energy prize 3
RET	return, related to the DH pipes
t	turbine
th	thermal
TOT	total value
y	year