Boosting energy efficiency and RES in urban contexts: from the plan to the project

Boosting energy efficiency and RES in urban context: from the plan to the project

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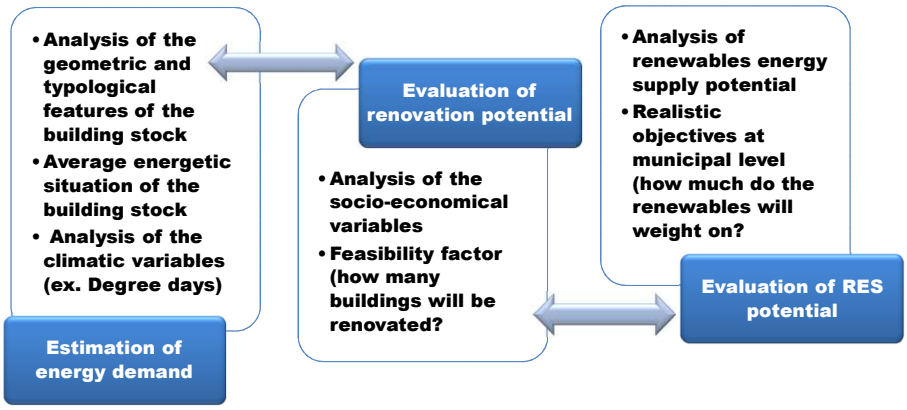
The concept

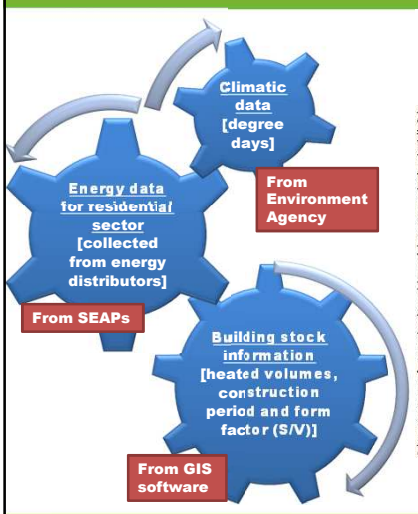
Objective of the work: *finding the appropriate solutions at municipal level to boost energy efficiency and RES through the energy dossier of the building code*

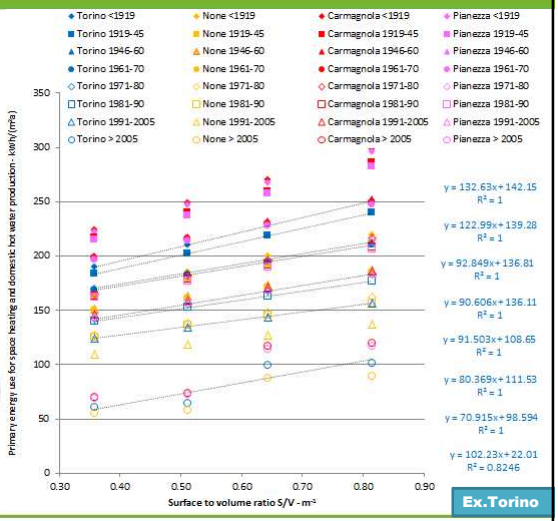


The estimation of thermal and electric energy demand

Cities on power

Space heating and DHW energy demand



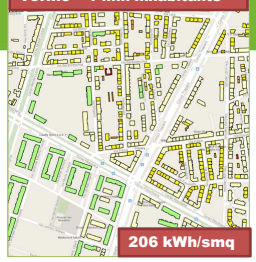


Ex.Torino

The estimation of thermal and electric energy demand

Cities on power

Torino – 1 mln inhabitants



206 kWh/smq

Pianezza –10000 inhabitants

235kWh/smq

Label	Torino				Pianezza			
	<0.45	0.45-0.56	0.56-0.71	>0.71	<0.45	0.45-0.56	0.56-0.71	>0.71
A	-	-	-	-	-	-	-	-
B	10	29	4	-	-	-	-	-
C	997	176	84	33	1	-	-	-
D	7541	6249	4965	1357	34	60	157	101
E	68	2095	3424	8794	30	96	281	410
F	-	-	-	4904	-	-	43	335
G	-	-	-	905	-	-	-	135
%	21%	21%	20%	38%	4%	9%	29%	58%

Electric demand

Per capita electric consumption from SEAP + Number of occupants

Geometric data (ex.total floor area)

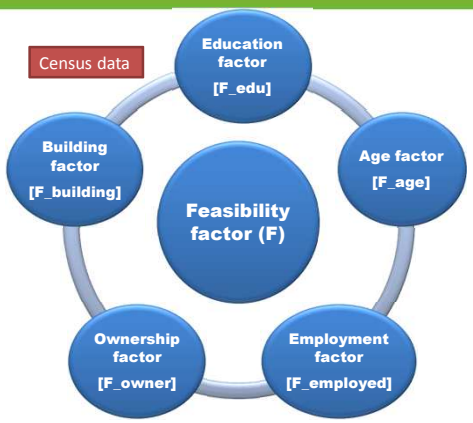
+ Occupancy factor from statistic agency

+ Per capita floor area from regional law

The renovation of residential buildings

Cities on power

To adapt the building code at local level is crucial to analyse the renovation feasibility factor



Age factor:
active population (24-65) / total population
Variables: ECONOMIC, DECISION, INTEREST

Education factor:
population with scholastic graduation / total population
Variables: AWARENESS

Employment factor:
employed people / total population
Variables: ECONOMIC, CREDIT ACCESS

Ownership factor:
dwellings owned / total dwellings
Variables: DECISION, INTEREST

Building factor:
small buildings (<2 dwellings)/ total buildings
Variables: DECISION PROCESS

Feasibility factor: estimation of the statistical inclination of citizens to renovate their own building, considering the physical condition of the object and the socio-economical variables.
*F= F_age * 0,30 + F_edu * 0,20 + F_employed * 0,20 + F_owner * 0,15 + F_building * 0,15*

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The renovation of residential buildings

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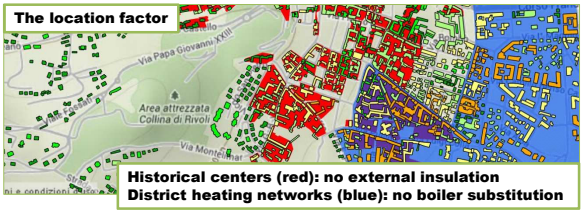
Feasibility factor (F) → 4 Statistical classes → Type of interventions → Energy demand reduction: a/ short term b/ long term

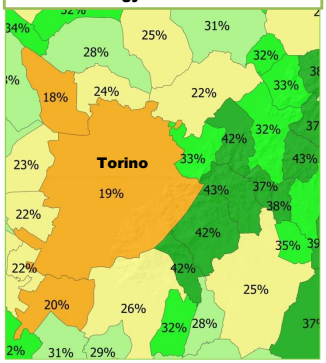
Location factor (F)

The location factor



Historical centers (red): no external insulation
District heating networks (blue): no boiler substitution

Application of the interventions – example of short term objectives: thermal energy demand reduction



Number of buildings (%)	First class	Second class	Third class	Fourth class
Province of Torino	13%	42%	39%	6%
City of Torino	20%	54%	23%	3%

Lower feasibility — Higher feasibility

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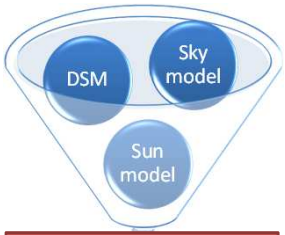
Satisfying energy demand with RES

Two renewables were considered in the analysis: the solar resource and the biomass

The solar resource



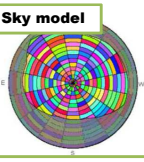
Software: GRASS GIS - Tool: r.sun

Solar radiation maps

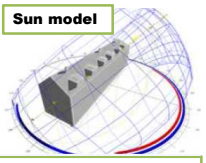
Digital Surface Model

Terrain + 3D buildings

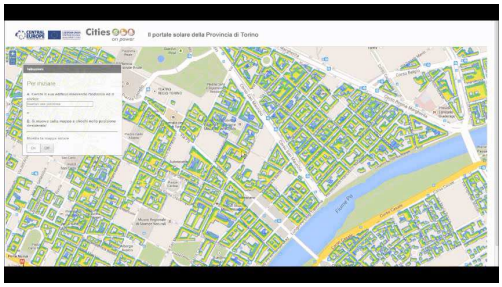
Sky model



Sun model

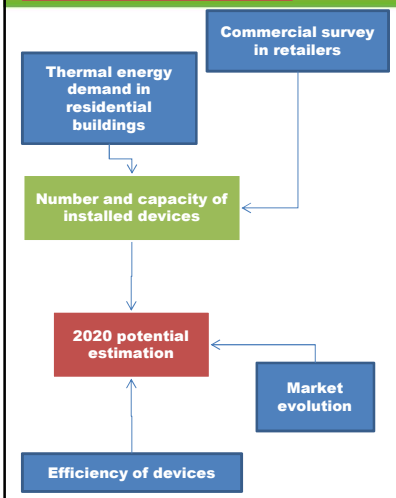


Turbidity factor, direct/diffuse radiation,ect



Satisfying energy demand with RES

The biomass resource



RES potentials

Municipalities		Torino	Pecetto T.	Nichelino	Pianezza
Inhabitants 2011		874.000	3.867	48.011	14.006
Buildings (A)		35.800	1.033	2.936	2.503
Apartments (B)		440.000	1.775	20.352	7.050
Typology (B/A)		12,3	1,7	6,9	2,8
Potentials [MWh] - *Per capita values*	PV	0,22	2,60	0,26	0,51
	ST	0,22*	0,21*	0,21*	0,18*
	Biom	0,15	3,40	0,42	1,40
Electric/thermal consumption from RES (max. %)		7%	60%	15%	27%

* Fixed value for the ST technology/ Residual roof space for PV

Conclusions

Cities on power

Smart cities

The policies must be adapted to local needs: each group of buildings (target of the analysis) will be renovated stimulating in different ways the owners/tenants (ex. Awareness, Financial incentives or spit incentives , Grants, ect)

The smart cities need smart policies based on deeper analysis but also a real involvement of citizens and private stakeholders is essential

GIS softwares have a great potential with multi-level and territorial topics.
The open source solutions are really competitive with commercial ones

The open data are a very powerful instrument, but:
-the availability is low
- the goodness is unfrequent
- we must intercept also data coming from the private sector
- not so many data are georeferenced

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Cities on power

The end!

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