Simulations of energy efficiency in urban planning

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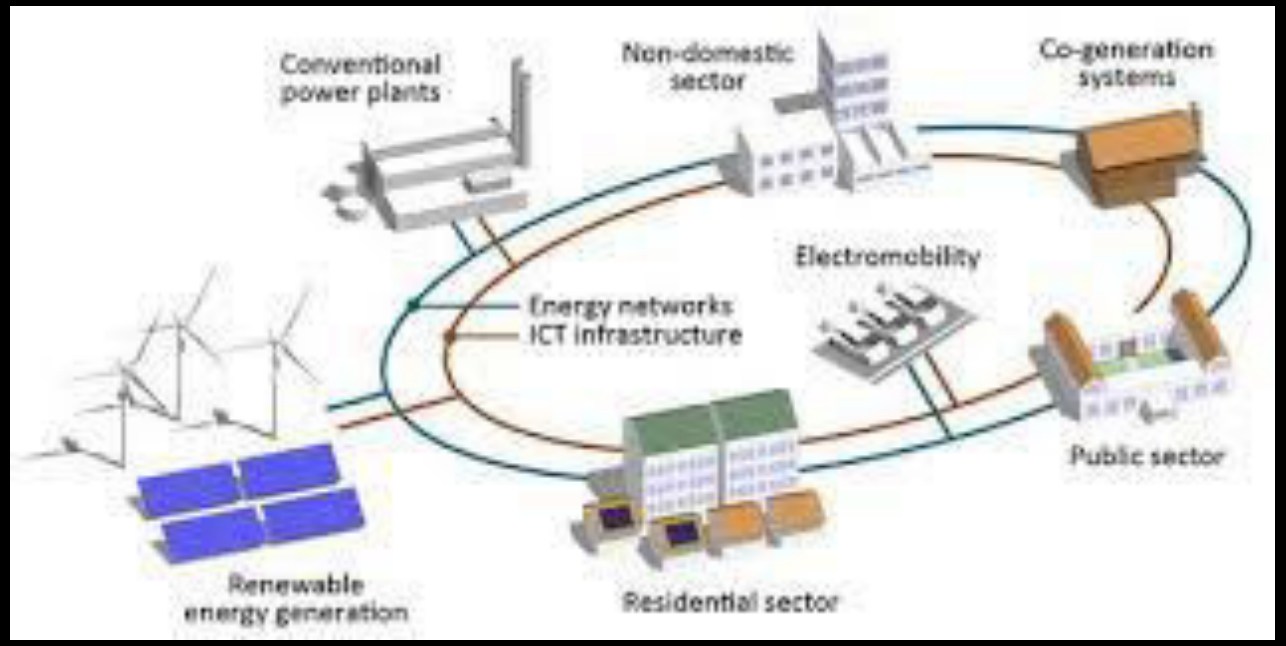
BuildSim Nordic 2018



Content

1. Energy simulation equation
2. Background
3. Case Ravilaakso
4. Conclusions

AIM:

Land Use and Buildning Act 1999: Section 9. Impact assessment in connection with planning.
Plans must be founded on sufficient studies and reports. When a plan is drawn up, the environmental impact of implementing the plan, [.. ..] must be assessed to the necessary extent…

- *Finding and developing tools for urban planning*
- *Transparency and facts for decision making*
- *Reducing energy and CO_2*
- *Easy to use for planners*

Energy planning on district level:

1. Potential *energy mix*
2. Energy consumption estimates (EPBD) with E-value
3. Calculation tools
4. Create an *energy concept &* alternatives
5. *Decision on Energy concept*

Case Ravilaakso, development in Vaasa

Competition 2014, Mandaworks

Dense redevelopment of race course

Innovative and energy efficient housing district

130 000 m^2 on 17 Hectare

Goals and potential:

Local climate agenda in Vaasa:

- 30 % reduction of CO_2 by 2020 (from 1990)
- Carbon neutral by 2035

Research reports:

“Spatial planning departments can influence the energy performance of construction projects, by stating conditions that must be met to obtain planning permission” (Immendoerfer, Winkelmann and Stelzer 2014)

“There is considerable energy saving potential in the urban planning (Rajala et al 2010).

“There as a need to reinforce the collaboration between architects, engineers and energy departments and networks” (PLEEC-project 2014).

The unbearable lightness of energy estimates in urban planning…based on EPBD-rules

$$\sum 90\%\ building\ right\ \ x\ \ E-value = Max\ energy$$

$$(Heating + Electricty)\ \times Energy\ mix\ = \sum CO_{2e}$$

Potential energy mix in Vaasa

- District heating 71 % renewables
- Electricty 62 % renewables
- Excess heat i summer
- Geothermal heat

- Photovoltaic & solar hot water, 100% renewables

Tools for simulations in planning:

KEKO/HEKO 2016

- No evidence of use in planning in Helsinki despite commitment, except co-operation with power company and 7-53 studies on different topics but none on energy
- Comprehensive for non-experts

Ecocity Evaluator

- Tool in Oulu, combined with strategy

District Energy Concept Advisor (D-ECA) 2013

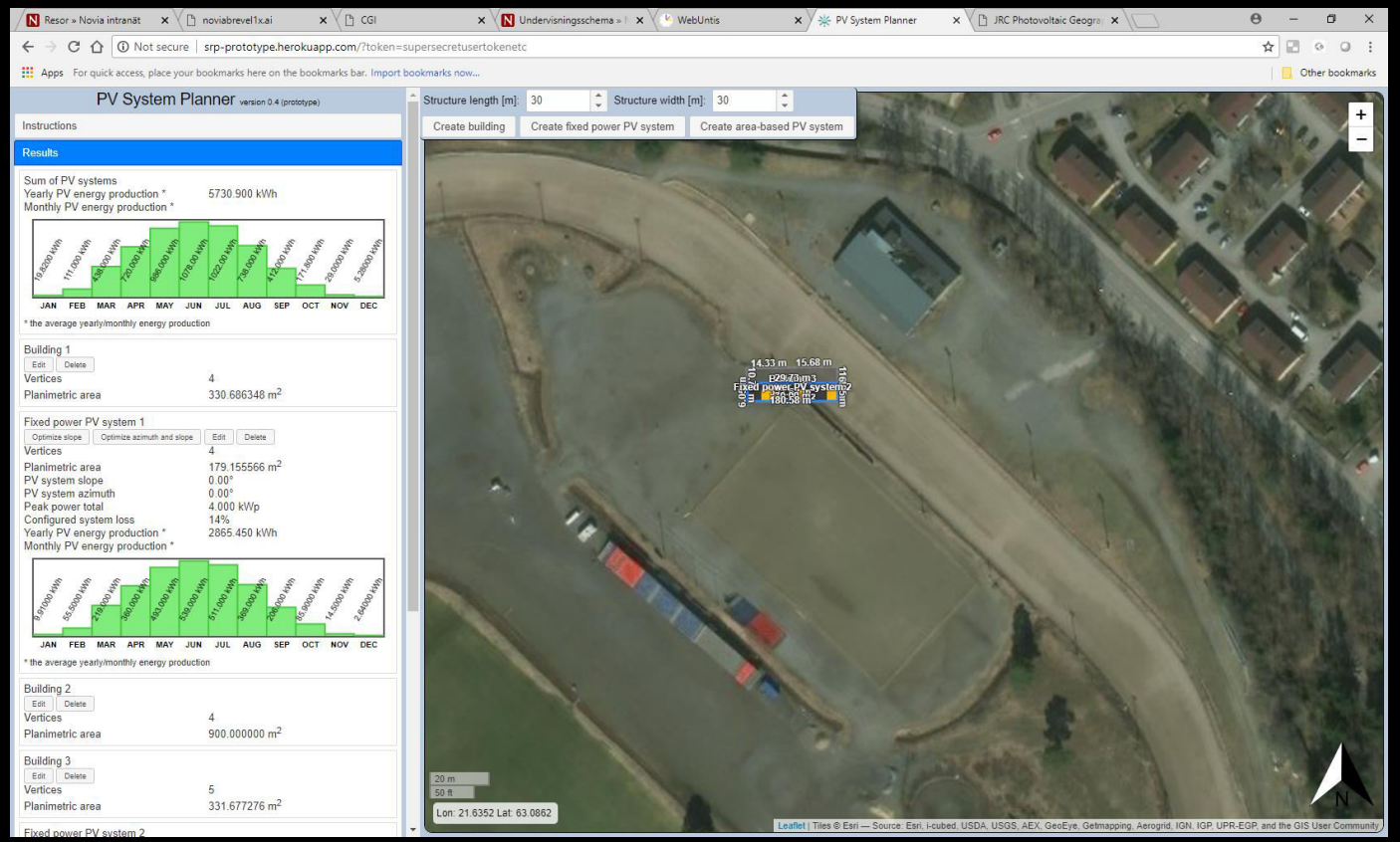
- Found no use of it in planning

--- Resistive professional cultures and a learning problem?

Solar energy potential estimates

- PV System Planner-application based on the PVGIS-project (EU)
- Parameters:
  - Area
  - Angel
  - Calender
  - Solar radiation

http://srp-prototype.herokuapp.com/?token=supersecretusertokenetc



Energy estimates in urban planning

Parameters:

- Building right
- Heated floor area
- Building types, use
- Primary energy coefficients
- Energy supply

Outcome:

- Alternatives and motivation
- Energy mix proposal
- Proposals for reduction (methods)
- Energy plan and decision making
- Implement in buidling permits and plot assigment contracts

Estimates for Ravilaakso

Energy consumption

	Building right 18.5.2017	Electricty with primary energy coefficient [MWh/a]	District heating with primary energy coefficients according to mix [MWh/a] (H:fors)
2012/D3	126 795	7 279	13 914
	10 230	408	1 565
Proposal 2018/D3	126 795	5 138	15 403
	10 230	288	1 645

Energy mix for heating

O-alternative, conventional district heating and electricty	7705
Ground heating	4431
Ground heating and storage of excessive heat in summer	3219
Ground heating in combination with solar panels	4067

Conclusions

Influenceable variables

- Local energy mix
- Building codes
- Shape of bildings, sun protection
- Materials
- Contracts

New tasks in planning processes

- Simulations and energy assessments
- Energy concepts
- Communication of alternatives based on facts
- Investor perspectives (energy, infrastructure, housing contractors)

Future and open questions:

- Further testing and implementation?
- CO_2 or geenhouse gas reduction or non-fossil fuels?
- Creating carbon sinks in buildings
- Prototype or final interface?

AIKO-project, with sponsors: