ERA 17

For an energy-smart built environment 2017

SITRA

ERA17 – Finnish action plan 2010-2017
EPBD recast implementation in EU

14.1.2011 Jarek Kurnitski

Suomen itsenäisyyden juhlarahasto Sitra

ERA 17 Finnish action plan 2010–2017

- Initiative to tackle 2020/2030/2050 targets
- Goal: to achieve 2020 targets in 2017

- Includes all major sectors and issues of built environment accounting for about 60% of total final energy use and CO_2 (centralized energy production and electric cars not included)
- Ended up with concrete policy measures for immediate implementation

- 31 proposals for 5 key areas prepared:
  - Roadmap for building regulation
  - Integrated land use planning
  - On site RES
  - Existing building stock package
  - R&D package

Preparation of ERA17 action plan

Background studies for the action plan:

- Final energy use and consequent emissions caused by built environment
- REHVA study on Benchmarking Regulations and Incentives on Energy Performance of Buildings in selected European countries (available in English)
- National energy scenario analyses until 2050
- Impact assessment for proposed measures

- ERA17 is a joint force of Ministry of the Environment, Sitra and Tekes, prepared by expert group of 40 persons led by Minister of the Housing, Jan Vapaavuori
- ERA17 includes follow up of implementation for 2 years

REHVA benchmarking:

- **Roadmap of some countries towards nearly zero energy buildings to improve energy performance of new buildings**
- **Many countries have prepared long term roadmaps with detailed targets**
- **Helps industry to prepare/commit to the targets**

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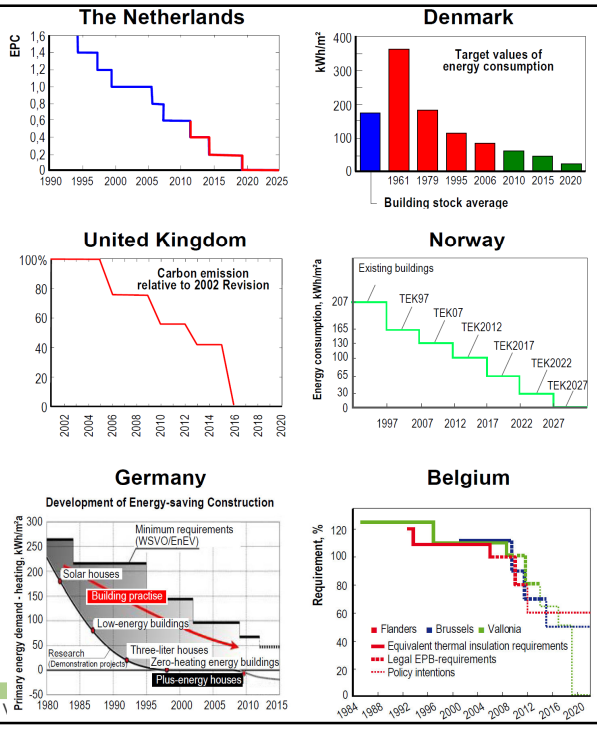

REHVA benchmarking study: incentives

Summary Table of Incentives			DE	IT	FR	Hu	BE	SE
	YEAR		2009	2009	2009	2009	2009	2009
FINANCIAL	Direct Funding of Energy Repairs		Yes	Yes	Yes	Yes	Yes	Stopped
	Financial Help for Low-Income Households		Yes	Yes	Yes	No	Yes	No
	Green Loans / Soft Loans		Yes	Yes	Yes	Yes	Yes	No
	Third Party Financing		Yes	Yes	Yes	Yes	Yes	No
TAXES	Tax Deduction		Stopped (2009)	Yes	Yes	No	Yes	Yes
	Lower VAT on Labour and Materials		Stopping	Materials	Labour & Material	No	Labour	n.a.
TECHNOLOGY SPECIFIC	Subsidies on Sustainable Energy Devices		Yes	Yes	Yes	Yes	Yes	Yes
	Feed-in Tariffs	per kWh (€/kWh)	Yes	Yes	Yes	Yes	No	n.a.
		Green Certificates	No	Yes	Yes	Yes	Yes	n.a.
OTHERS	Rent Indexation (Owner-Renter Balance)[1]		n.a.	n.a.	n.a.	No	n.a.	No

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REHVA benchmarking study

Reported national practices and trends, some findings:

- **the new building regulation applied on renovations in most of countries, but in different ways, in some countries almost all requirements apply for major renovations**
- **innovative systems (such as demand controlled systems or ground loop systems etc.) difficult to handle/ not yet included in "official" calculation process**
- **calculation procedures based mainly on national methods, dynamic calculation accepted in some countries**
- **most of the countries use primary energy in definition of energy performance in [kWh/m²,a] – EPBD has established a common methodology**
- **still many differences in details of energy calculation frame: boundaries, reference building approaches, calculation rules…**

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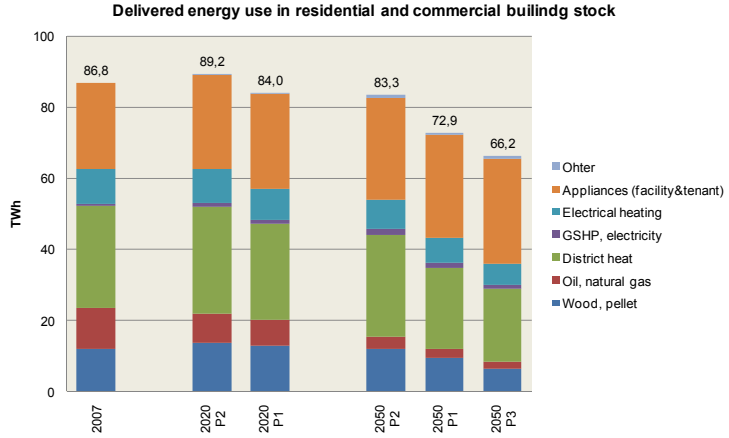
Finland: Decoupling for all energy used in the building stock soon possible



P1: 50% heating energy reduction in all major renovation

P2: no reduction at all in major renovations (compensated by quality improvements)

P3: theoretical, all building stock renovated to meet 2010 requirements in 2050

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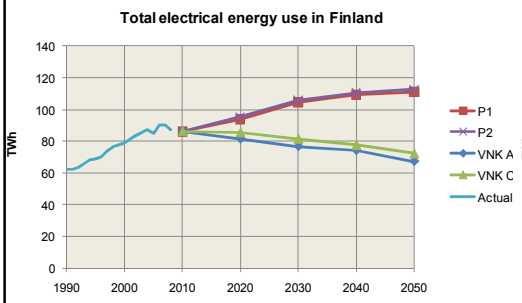
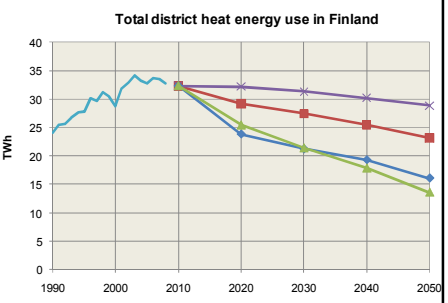
Despite of reduced total energy use in 2020, electricity use will most probably continue to increase

Electricity



District heat



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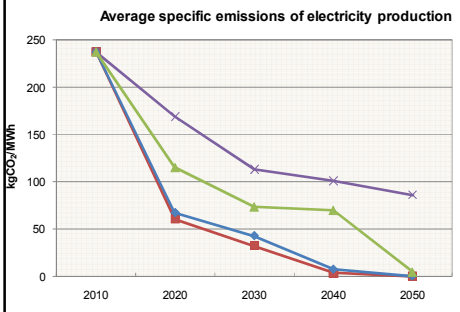
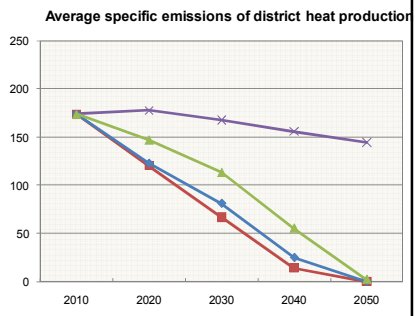
Specific emissions estimated to be roughly the same in the long term for the electricity and district heat

Electricity



District heat

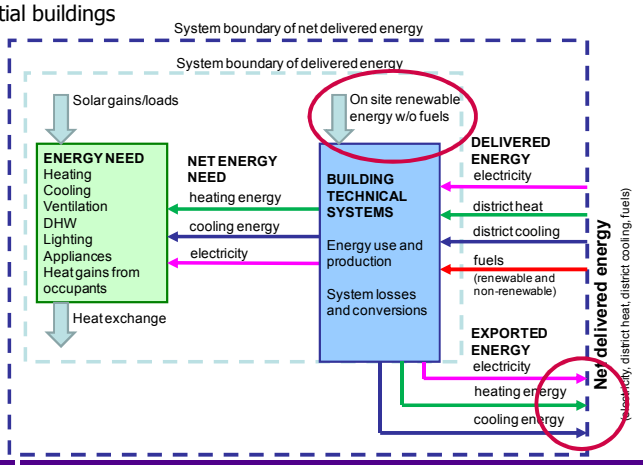


ERA17 measures with the highest impact

- Net zero energy building regulation for new buildings
  - roadmap of code requirements for next 10 years
  - will mostly meet "cost optimal" criterion, except PV needing feed-in tariff
  - reasonable cost, and savings even higher compared to existing building stock
- Improvement of existing building stock
  - incentives needed, not cost efficient in buildings with district heating
  - cost efficient in electrically heated houses, still incentives needed to activate
- Integrated land use planning with increased density (UGB etc.)
  - almost no cost at all, savings through cheaper infrastructure
  - better utilization of local energy supply solutions
  - less vehicle km per person – significant reduction in fossil fuels
- Built environment can use 20-35% less energy in 2050 relative to 2010
- Most of investments cost effective, improving living and working quality

Next step: 2012 building code

- Zero energy building compliant energy frame and calculation methodology
- Requirements tightened already 2008 and 2010, from 2012 based on **primary energy**
- 2012 performance level roughly equal to primary energy requirement of passive houses in residential buildings



EPBD 2002, EuP 2005, RES 2008, EPBD recast 2010 have resulted regulation revisions in 2-3 years interval

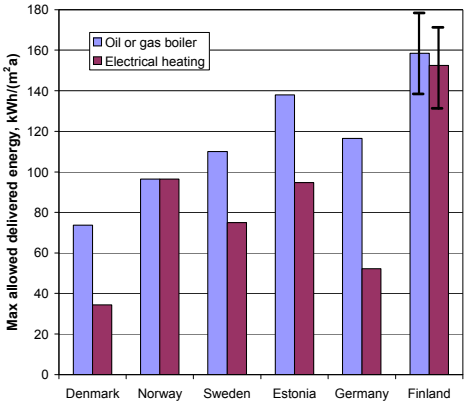
Source: Kurnitski J. Contrasting the principles of EP requirements and calculation methods in EU member states. *REHVA journal, December 2008, 22–28.*

- Situation in the member states after EPBD implementation in June 2008 regarding EP requirements for new buildings and calculation methods
- In the figure, the most developed available calculation method is shown; in many countries simplified methods may used in parallel or for some building type

EP-value comparison, 2008 data

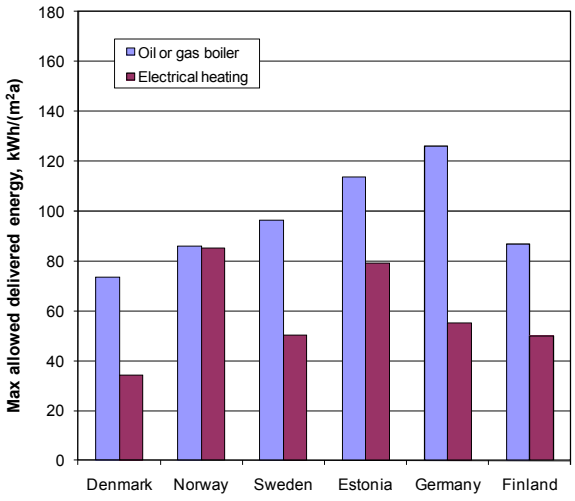
Source: Kurnitski J. Contrasting the principles of EP requirements and calculation methods in EU member states. *REHVA journal, December 2008, 22–28.*

- The figure shows maximum allowed **delivered energy without household electricity** (i.e. delivered energy to heating, hot water and ventilation systems) in each country for fossil fuel or electrical heating
- In the comparison, the degree-day corrected data is used, all values are corrected with 17°C degree-days to Copenhagen
- Component-based regulations causes significant penalties for Finland
- The data represents the situation in 2008, and is not up to date, due to regulation changes at least in Sweden and Finland



New reg. from 2010 2010

2008 data, but Sweden 2010 and Finland 2012



ERA 17 2012 energy calculation methods

- Advanced buildings/**innovative systems** need advanced calculation methods – no alternatives for dynamic simulation tools
- Energy simulation/commercial simulation tools will become major calculation method in Finland 2012:
  - dynamic simulation required in buildings with cooling system (both for mechanical and free cooling) due to heat transfer dynamic phenomenon
  - summer overheating/room temperatures to be simulated in all buildings in typical rooms – leads to some (free?) cooling in apartment buildings
  - exception for single family houses, there simulation is not needed if some simple rules (solar protection, window size and openings) are met
- Requirement of the validated simulation software in the code, all relevant European and other validation standards accepted
- Initiative for tools testing/comparison planned (voluntary R&D activity)

2012 määräysvalmistelussa käynnistettyjä kehityshankkeita Ympäristöministeriön ja Sitran Energiaohjelman rahoittamana

1. Energiamuodon huomioon ottaminen määräyksissä: päästö- ja primäärienergiakertoimien taustaselvitys
2. Laskennassa käytettävien säätietojen tarkistaminen: uuden energialaskennan testivuoden kehittäminen
3. Kylmäsiltojen huomioon ottaminen määräyksissä taulukkoarvoilla + yksityiskohtaisempi laskentaopas
4. Lämmitys- ja LKV- järjestelmien hyötysuhteiden taulukkoarvojen päivitys + yksityiskohtaisempi laskentaopas
5. Aurinkolämmön ja -sähkön laskentaohjeet + laskentaopas
6. Lämpöpumppujen laskentaohjeet + laskentaopas
7. Jäähdytysjärjestelmien laskentaohjeet + laskentaopas
8. Määräysvalmistelun projektisihteeri
9. 2012 E-lukujen vaatimustasojen laskenta

D3 kokonaisenergiankulutuksen vaatimus (lausuntoversio)

2.1.4
Uudisrakennuksen E-luku ei saa ylittää seuraavia arvoja:

Luokka 1	Erillinen pientalo, rivi- ja ketjutalo	$182 - 0{,}15 \cdot A_{netto}$ kWh/(m^2 a) kun A_{netto} <150 m^2 ja $170 - 0{,}07 \cdot A_{netto}$ kun $A_{netto} \geq 150$ m^2 Hirsitalo $202 - 0{,}15 \cdot A_{netto}$ kWh/(m^2 a) kun A_{netto} <150 m^2 ja 190 $0{,}07 \cdot A_{netto}$ kun A_{netto} >150 m^2 Alle 100 m^2 loma-asunto ei E-luku vaatimusta;
Luokka 2	Asuinkerrostalo	140 kWh/(m^2 a);
Luokka 3	Toimistorakennus	190 kWh/(m^2 a);
Luokka 4	Liikerakennus	270 kWh/(m^2 a);
Luokka 5	Majoitusliikerakennus	280 kWh/(m^2 a);
Luokka 6	Opetusrakennus ja päiväkoti	190 kWh/(m^2 a);
Luokka 7	Liikuntahalli (pois lukien uima- ja jäähalli)	180 kWh/(m^2 a);
Luokka 8	Sairaala	500 kWh/(m^2 a);
Luokka 9	Muut rakennukset ja tilapäiset rakennukset	ei E-luku vaatimusta.

Energiamuotojen kertoimet (lausuntoversio)

- Rakentamisen ohjauksen kertoimet
- Teoriassa useita eri tapoja määrittää kertoimet (primäärienergia, päästöt, hinta, kapasiteetti, suomalainen/eurooppalainen markkina, skenaariot…)
- Ottavat huomioon erityisesti primäärienergian (EPBD), mutta myös päästöt ja kapasiteettipulan sekä korreloivat energian hinnan kanssa
- Energiajärjestelmän edistyksellisyys ja tulevat investoinnit päästöleikkauksiin otettu huomioon sähkön ja kaukolämmön kertoimissa

Sähkö	2,0
Kaukolämpö	0,7
Kaukojäähdytys	0,4
Fossiiliset polttoaineet	1,0
Uusiutuvat polttoaineet	0,5

EPBD recast 19.5.2010 – major changes (1/4)

- Article 3 Adoption of a energy calculation methodology
  - Reference to CEN standards, RES and EuP directives to be taken into account
  - Primary energy to be calculated
- Articles 4 & 5 Setting of energy performance requirements
  - Setting of minimum energy performance requirements based on calculation of **cost-optimal** levels with the methodology referred to in Article 3.
  - The calculation of cost-optimal levels shall be performed in accordance with the methodology developed by the Commission (so called comparative methodology Annex III)
  - Primary energy target values have to be set in kWh/m2
  - The Commission shall establish by 30 June 2011 a comparative methodology framework
  - Member states shall report by 30 June 2012

EPBD recast – major changes (2/4)

- Article 6 New buildings
  - The 1000m² limit removed from articles dealing with renovation of existing and new building RES etc.
- Article 7 Existing buildings
  - Requirements for new buildings apply also to all buildings under major renovations (1000m2 limit removed)
  - When technically, functionally and economically feasible
  - Requirements can be set also at component level
- Article 8 Specific regulations needed also for technical systems – existing compulsory, new buildings optional

EPBD recast – major changes (3/4)

- Article 9 **Nearly zero energy buildings**
  - By 31 Dec 2020, all new buildings are **nearly zero energy** buildings
  - After 31 Dec 2018, public authorities that occupy and own a new building shall ensure that the building is a nearly zero energy building
- Article 9a Financial Incentives and Market Barriers
  - Measures to overcome market barriers are requested
- Article 10 Energy performance certificates
  - Stronger and more meaningful position needed for energy certificates (incl. cost-effectiveness)

EPBD recast – major changes (4/4)

- Article 13 Inspection of heating systems
  - From boiler inspections to heating system inspections
- Article 14 Inspection of air-conditioning systems
  - In A/C inspections more emphasis is put on reducing cooling loads
- Article 17 Independent control system
  - Independent controls system for all national inspections

http://eur-lex.europa.eu/JOHtml.do?uri=OJ%3AL%3A2010%3A153%3ASM%3AEN%3AHTML

Direktiiviä toimeenpanevien kansallisten säädösten tulee olla annettu ja julkaistu viimeistään 9.7.2012

EPBD recast – Nearly zero energy buildings

- In the directive 'nearly zero-energy building' means a building that has a very high energy performance. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby.
- Since the Commission does not give minimum or maximum harmonized requirements, it will be up to the Member States to define what for them exactly constitutes a "very high energy performance"

National roadmaps towards nearly nZEB

- National roadmaps towards nearly zero energy buildings are needed for all member states
- The national plans shall include, inter alia, the following elements:
  a) the Member State's detailed application in practice of the definition of nearly zero-energy buildings
  b) intermediate targets for improving the energy performance of new buildings, **by 2015**
  c) information on the policies and financial or other measures adopted in the context of for the promotion of nearly zero-energy buildings

REHVA Task Force "Nearly Zero Energy Buildings" nZEB

- **REHVA experts have realized the problem various definition of nearly zero energy building may cause in Europe**
- **Focuses on definitions and energy boundaries and will help the experts in the member states in defining the nearly zero energy buildings in a uniform way**
- **Proposes general definition format to clarify the exact technical meaning of EPBD requirements in order to support national implementation**
- **Provides comprehensive framework including how to define the various energy flows and how to establish the energy boundaries on the building, affecting the performance levels of nnZEB building definitions**

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REHVA TF nZEB – draft definitions

net zero energy building (nZEB)
energy use of 0 kWh/(m^2 a) primary energy

NOTE 1 A nZEB is typically a grid connected building with very high energy performance that balances its primary energy use so that primary energy feed-in to the grid or some other energy network equals to primary energy delivered to nZEB from energy networks. Annual balance of 0 kWh/(m^2 a) primary energy use typically leads to the situation where significant amount of the on-site energy production will be exchanged with the grid. Therefore a nZEB produces energy when conditions are suitable, and uses delivered energy during rest of the time.

nearly net zero energy building (nnZEB)
national cost optimal energy use of > 0 kWh/(m^2 a) primary energy

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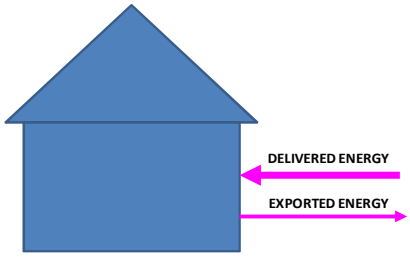
REHVA TF nZEB – system boundary



$$E = \sum_i \left(E_{del,i} - E_{exp,i} \right) f_i$$

System boundary for nearly net zero energy building definition, connecting a building to energy networks. Net delivered energy is delivered $E_{del,i}$ minus exported energy $E_{exp,i}$ accounted separately for each energy carrier *i*. Primary energy *E* is calculated with primary energy factors f_i as shown in the figure.

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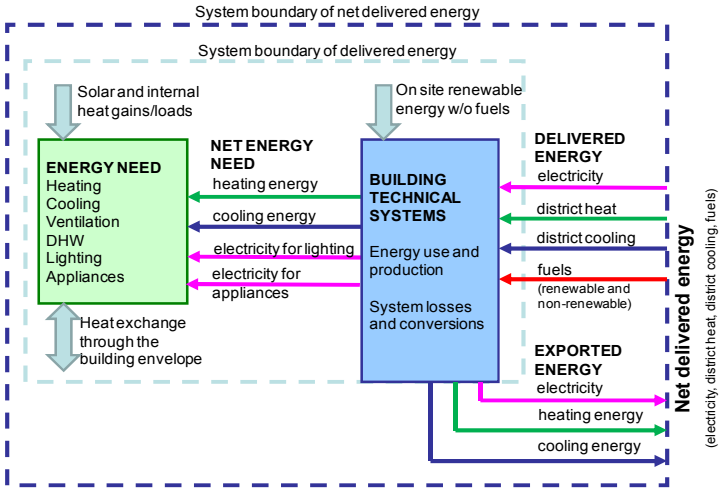
nZEB – detailed system boundary



Energy boundary of net delivered energy. The box of "Energy need" refers to rooms in a building and both system boundary lines may be interpreted as the building site boundary.

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REHVA TF nZEB results to be announced in *REHVA AM 2011 TALLINN*

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REHVA AM 2011 TALLINN

REHVA Annual Conference
May 19 - 20, 2011
Towards net zero energy buildings
and building labelling

Meriton Grand Conference & Spa hotel, Tallinn, Estonia

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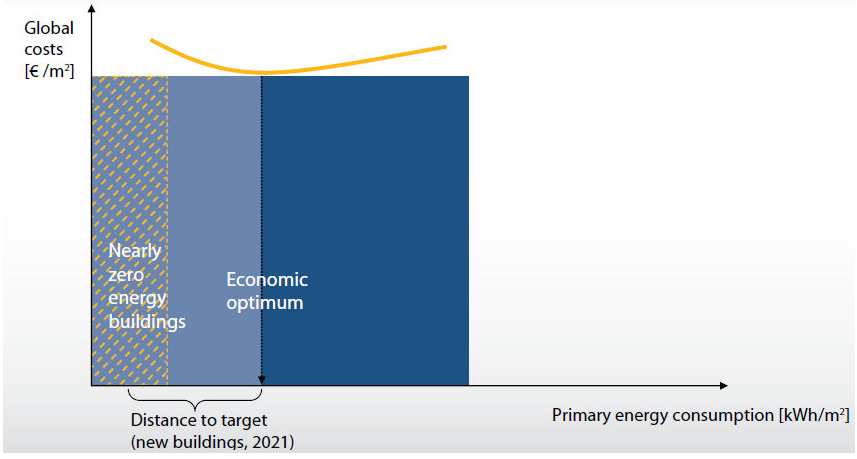
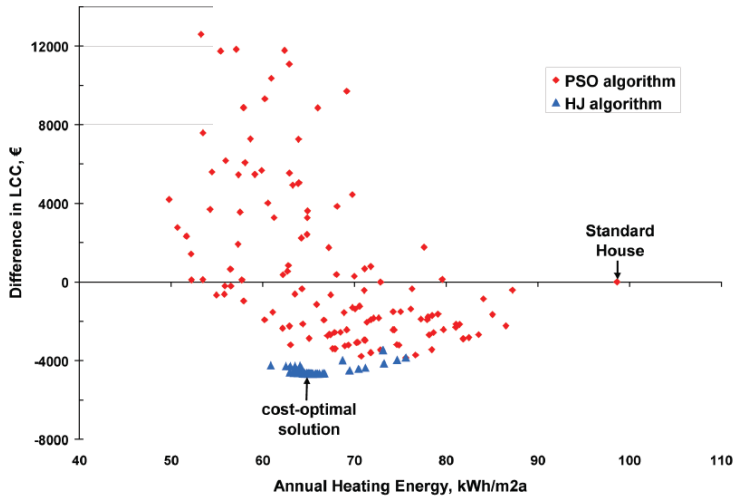
Cost optimal performance levels



Source: The Buildings Performance Institute Europe (BPIE):
http://dl.dropbox.com/u/4399528/BPIE/BPIE_costoptimality_publication2010.pdf

Example of cost optimal calculation, electrically heated house, according to Finnish code req. 2010

(Ala Hasan, REHVA Journal, Dec 2010)



KENA: Definitions and guidelines for **low energy** and **nearly zero energy** buildings

Type of building	Energy performance value, kWh/(m²·a)						
	A **Nearly-zero**	B **Low-energy**	C	D **New buildings**	E **Reconst-ruction**	F	G
Detached house							
Apartment building							
Office building							
Schools							

- Cost optimal delivered energy based on minimum total cost (investment and operation) during 30 years period.
- Different low-energy building concepts, "passive" vs. GSHP, etc.