European Committee for Standardization
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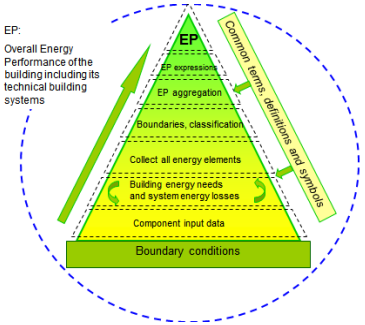
The 2nd generation of EPB standards a firm basis for the NZEB definition; outcome of EU-MANDATE-480 to CEN



Jaap Hogeling
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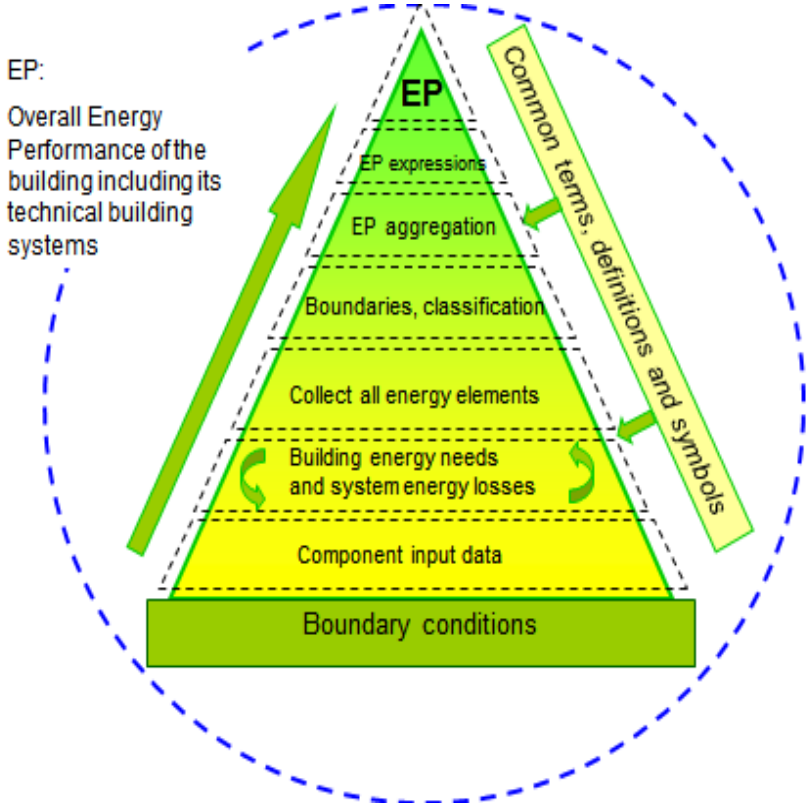
BUILDING SERVICES RESEARCH INSTITUTE THE NETHERLANDS

Current set of CEN EPBD standards is under revision (M480)

- Today we have total 42 standards: 31 EN and 11 ISO-standards published in 2007-2008

Most are **used** in many EU Member States, as required by national legislation based the EPBD implementation

by 2016 a total revised and completed set will become available



First results

- prEN 15603:2013 Over-Arching Standard
- prCEN TR 15615 (Technical Report) on the prEN 15603

Supporting Technical Specifications for the EPB standard developers

- CEN prTS 16628: Technical Specification on Basic Principles
- CEN prTS 16629 TS on Detailed Technical Rules
- Software tool to support the checking of the calculation procedures given in the various standards and their interconnection

Interactions of CEN TC371 experts and EU Member States experts facilitated by a Liaison Committee: exchange of information and views to make the set of EPBD standards meet the Member States requirements

prEN15603 Energy Performance of Buildings — Overarching Standard

- Common terms, definitions and symbols;
- Specifies a general framework for the assessment of overall energy use of a building (assessment boundaries / partitioning) ;
- Calculation of energy ratings in terms of primary energy or other energy related metrics.
- The EP assessment is not limited to the building and takes the wider environmental impact of the energy supply chain into account .

prEN15603 Overarching standard

- Calculated and measured energy rating
  - Procedure, set of equations per energy use,
  - Building **energy needs**
  - Technical building systems losses → **energy uses**
  - Contribution Renewable energy
  - Issues like:
    - Climatic data, indoor environmental requirements
    - Time-steps (monthly, hourly, how to convert?…)
    - Operating conditions (indoor environmental data and occupancy schedules, etc.)

Accompanying informative Technical Report TR 15615 to the prEN15603

- For all EPB standards is valid: the complexity of the building energy performance calculation requires guidance and good documentation and justification of the procedures.
- But this informative text is required but it is separated from actual normative procedures to avoid confusion and a unpractical heavy standards .
- Parallel to the prEN15603 an accompanying Technical Report CENprTR15615:2013 has been prepared

Current status of the prEN15603

enquiry closed 2nd of October 2013- ready for FV by April 2014

- Majority of the CEN members voted yes on the possible acceptance as an European Standard.
- Most No-votes and conditional Yes-votes can be resolved by two changes and more clarification:
  - Indicate **normative Annex A as informative** or alternative: make only the reporting format normative and give the defaults and options only in an informative Annex
  - Support and allow more explicit **visibility for the Monthly** Calculation procedures although the standard will continue to support hourly procedures as most favourite.
  - more clarification on how the **partitioning** should be handled

Definition of NZEB in the EPBD (art 2)

a very low amount of energy required for heating, cooling, ventilation, hot water and lighting taking in account:

- indoor climatic conditions;
- thermal characteristics of the building;
- HVAC installation, domestic hot water supply, built-in lighting installation;
- active solar systems and other systems based on energy from renewable sources;
- district or block heating and cooling systems.

to be covered, to a very significant extent, by Renewable Energy including Renewable sources produced on-site or nearby.

Nearly Zero Energy Buildings

- The EN 15603 will address this issue in an informative Annex
- A first proposal for NZEB: a hurdle race as presented in the on-going discussion in CENTC371-WG1
- In the TR 15615 there will be more freedom to give more details
- **The philosophy is** : before defining what a NZEB is we have to **agree on the minimal requirements** for the **comfort** level (indoor environmental performance), **building thermal** performance and **building systems** performances like illustrated in the next slide

The CEN first proposal for NZEB: a hurdle race
An (informative) ANNEX on NZEB in FprEN15603

Start

Arrival

Hurdle 1:
Comfort

Hurdle 2:
Building needs

Hurdle 3:
Building use

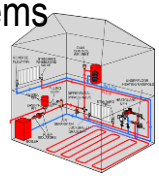
Hurdle 4:
Energy balance (PE)

NZEB

Indoor climate

Conditioned space

Technical building systems



Energy carriers

Primary energy carrier balance

Evolution of assessment boundaries

CEN proposal for a common but flexible frame

Within this flexible common structure the EU Member States can set up their level of requirements according to their priorities e.g. :

- more focusing on the building envelope;
- more focusing on the total primary energy,
- allowing one energy carrier to be compensated by another (e.g. Gas replaced by PV onsite in the yearly balance) or just awarded based on the grid Primary Energy Factor (PEF)
- etc.

CEN combined the definition of NZEB's and the different EPBD requirements in one assessment

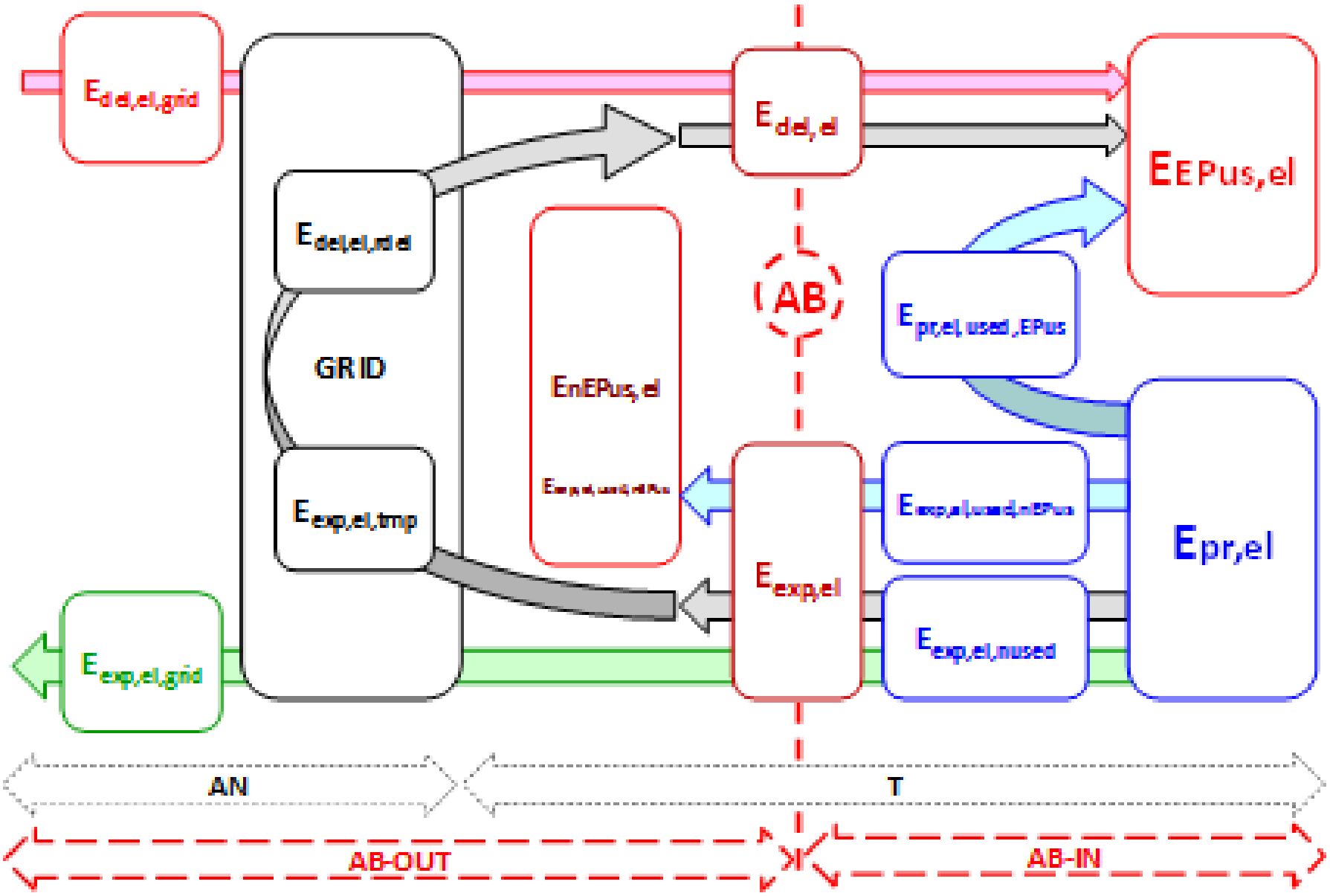
- **Common method:** (hurdle race). By following the hurdle race negative side effects can be avoided.
- **Flexible:** The MS's can set level of requirements according to their priorities within this CEN assessment structure.
- This EPBD NZEB framework for requirements is :
  - a significant contribution to EU commitments (e.g. climate change)
  - huge challenge for the EU building sector.

Hurdle 4:
Energy balance (PE)

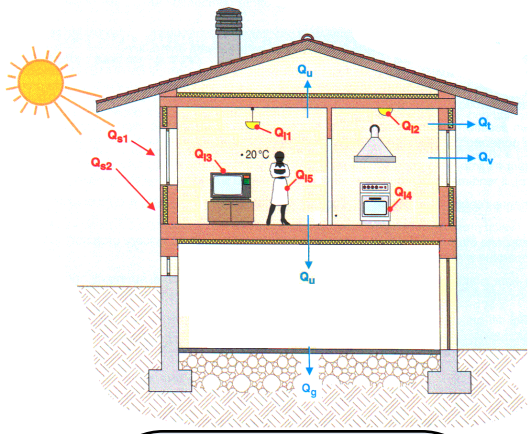
Energy performance

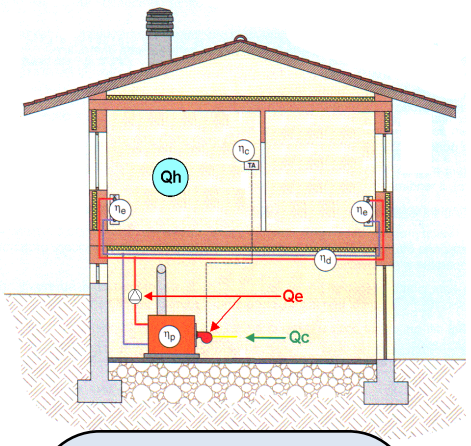
Delivered, exported and primary energy

electricity balance: how to reward of produced electricity



General calculation sequence





Building energy balance

$Q_{H,nd}$

Building energy need

Technical systems use

$E_{H,gen,in}$

Delivered energy

Energyware

Final conversion

Primary energy

...

Costs

...

Emissions

EN 15603 – PRIMARY ENERGY

"energy that has not been subjected to any conversion or transformation process"

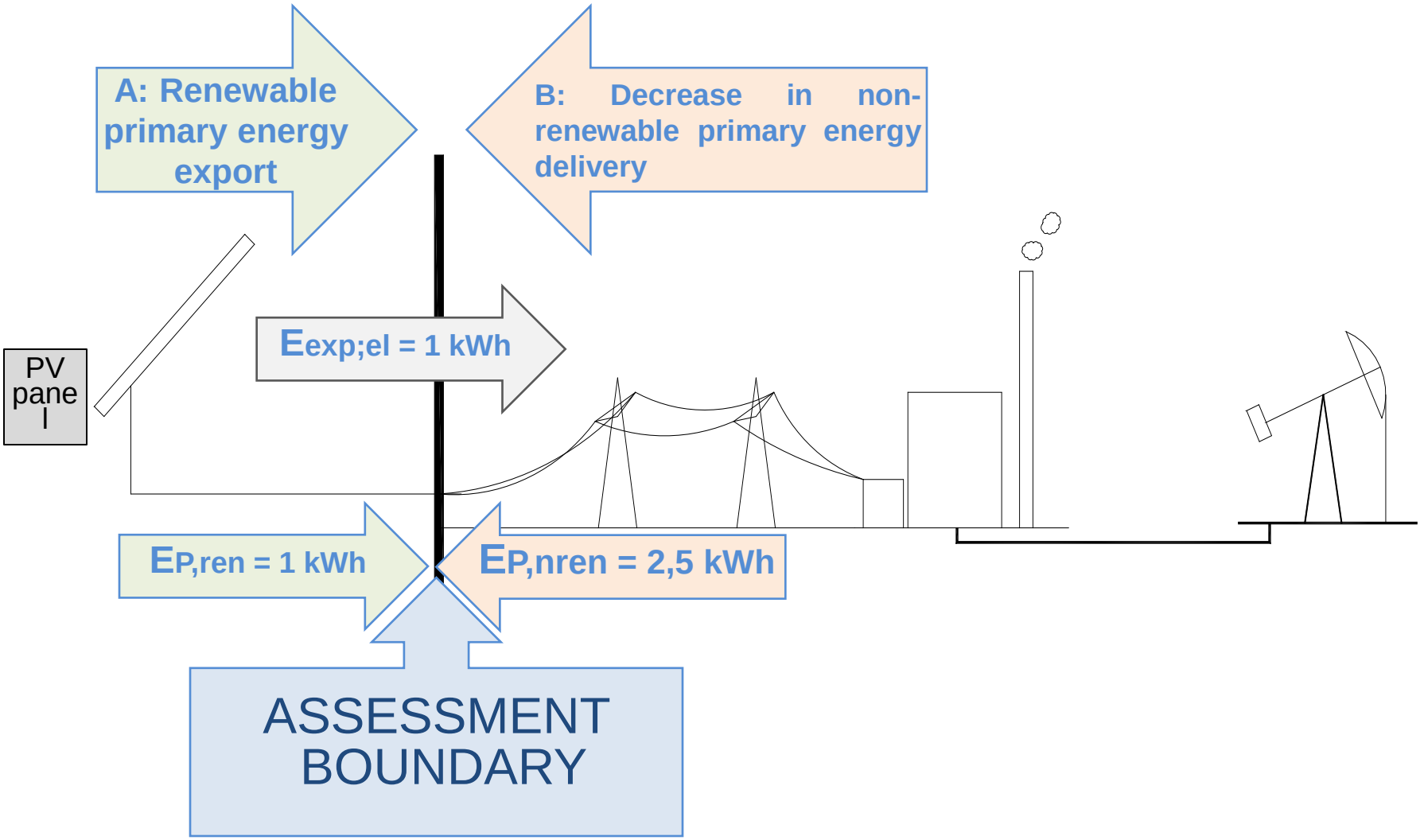
Primary energy includes two components

- **Non renewable primary energy**
- **Renewable primary energy**
- **Total primary energy** (sum of renewable and non renewable)

Primary energy **may or may not** include the following overheads:

- Transport and distribution losses and energy costs
- Capture, transport and distribution infrastructures energy costs

Exported: only step A or also step B?

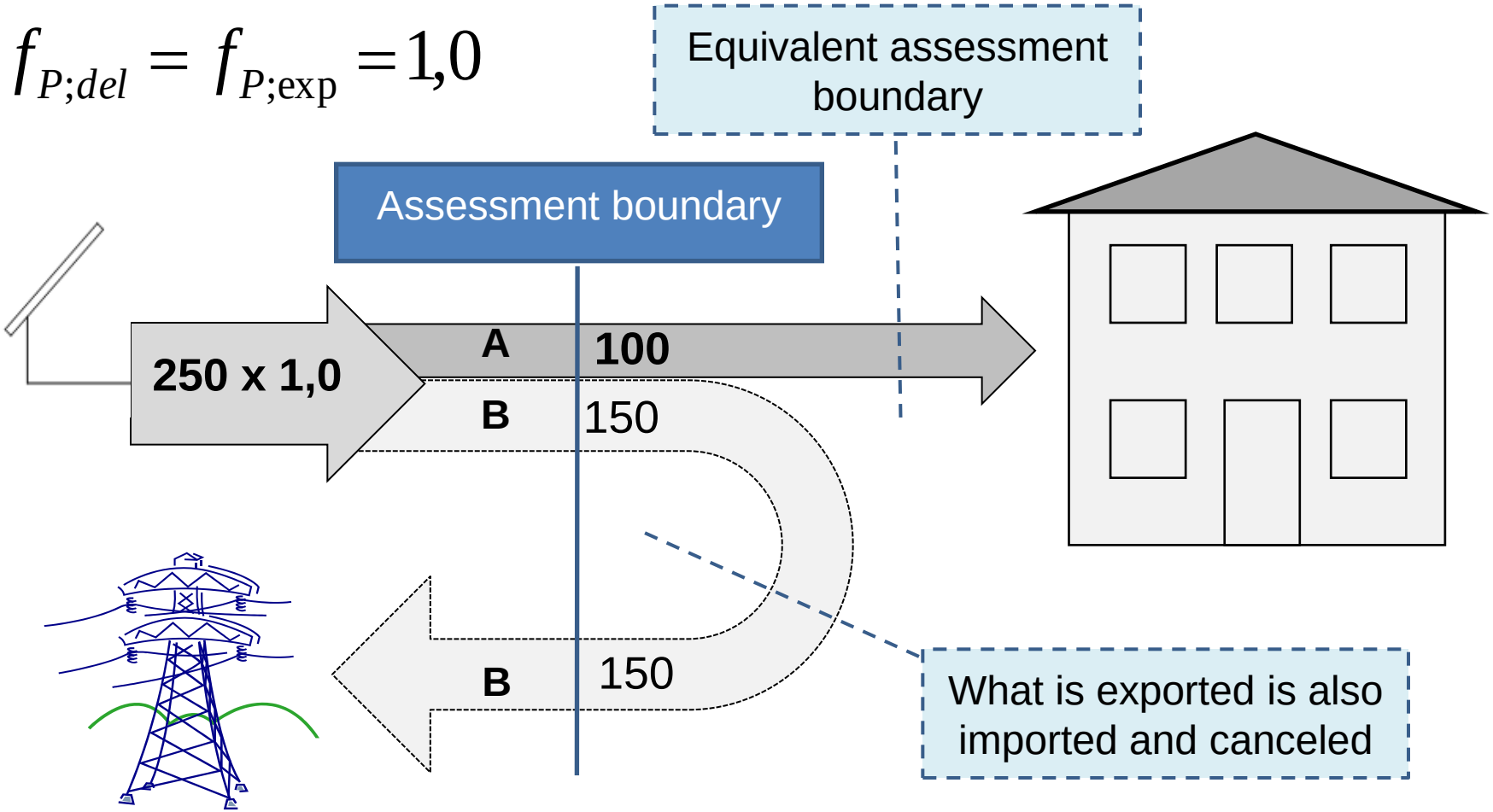


Current table in Annex → B with penalties

Energy carrier	Non-renewable primary energy factor	Renewable primary energy factor	Total primary energy factor	Choice for f_P rating
Delivered from distant	$f_{P;del;nren;cr,i}$	$f_{P;del;ren;cr,i}$	$f_{P;del;tot;cr,i}$	
Gas	1,05	0,00	1,05	nren
Grid electricity	2,30	0,20	2,50	nren
Grid electricity by hydraulic power plant	0,50	1,00	1,50	nren
Liquid biomass and biogas	0,50	1,00	1,50	nren
Wood	0,05	1,00	1,05	nren
Delivered from onsite	$f_{P;del;nren;cr,i}$ –	$f_{P;del;ren;cr,i}$ –	$f_{P;del;tot;cr,i}$ –	
Solar PV on site	0,00	1,00,	1,00	nren
Thermal solar on site	0,00	1,00	1,00	nren
Exported to the grid	$f_{P;exp;nren;cr,i}$	$f_{P;exp;ren;cr,i}$	$f_{P;exp;tot;cr,i}$	
Cogeneration unit electricity (non-renewable fuel)	1,60	0,00	1,60	nren
PV electricity	1,60	0,00	1,60	nren
Temporary exported and reimported later	$f_{P;exp;nren;cr,i}$	$f_{P;exp;ren;cr,i}$	$f_{P;exp;tot;cr,i}$	
Cogeneration unit electricity (non-renewable fuel)	2,00	0,00	2,00	nren
PV electricity	2,00	0,00	2,00	nren
Exported for immediate use	$f_{P;exp;nren;cr,i}$	$f_{P;exp;ren;cr,i}$	$f_{P;exp;tot;cr,i}$	
Cogeneration unit electricity	2,50	0,00	2,50	nren
PV electricity	2,50	0,00	2,50	nren

Step A: energy to the building

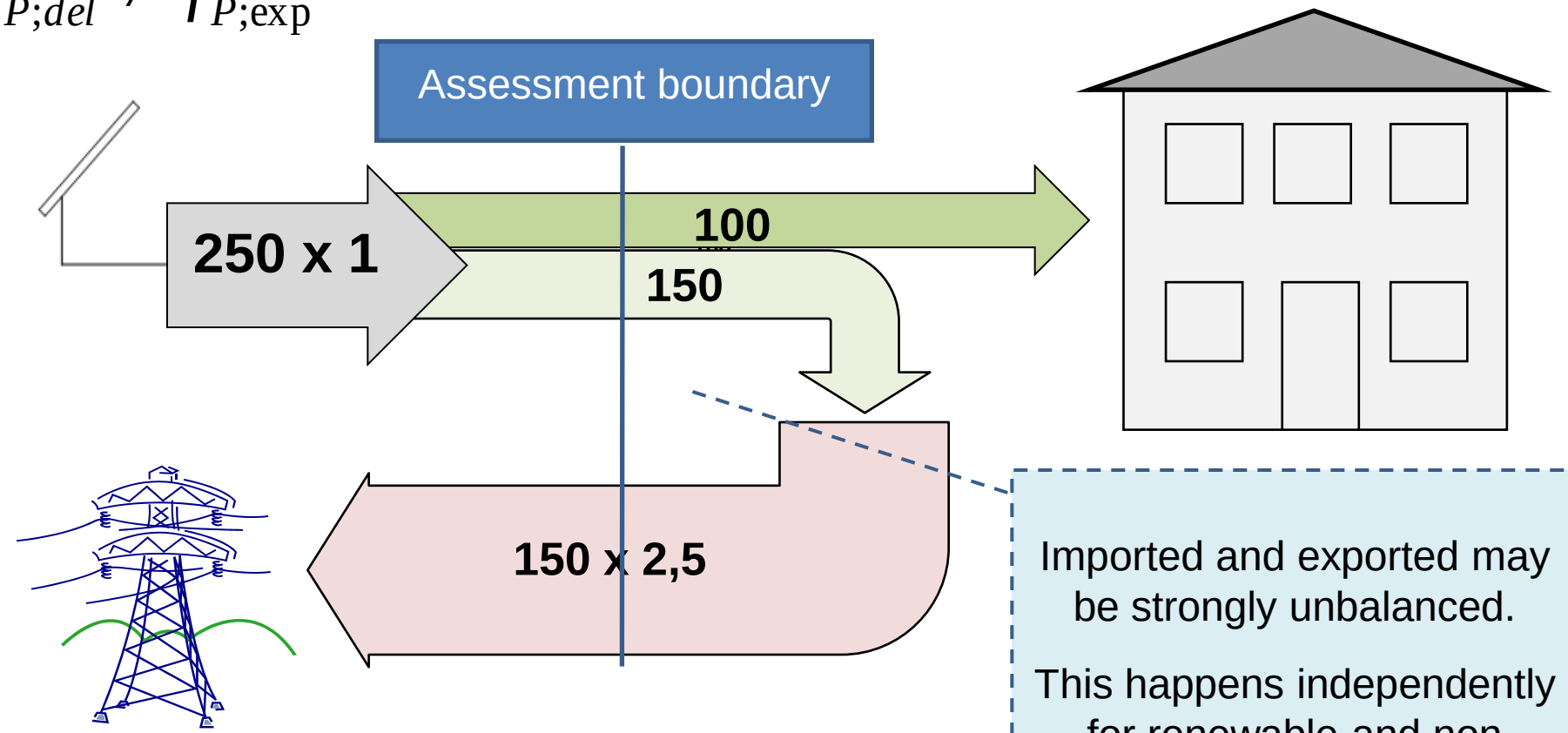
$$f_{P;del} = f_{P;\exp} = 1{,}0$$



$$E_P = E_{del;A} \cdot f_{P;del;A} + E_{del;B} \cdot f_{P;del;B} - E_{\exp;B} \cdot f_{P;\exp;B} = E_{del;A} \cdot f_{P;del;A}$$

If we use B: also effect on external world

$$f_{P;del} \neq f_{P;\exp}$$

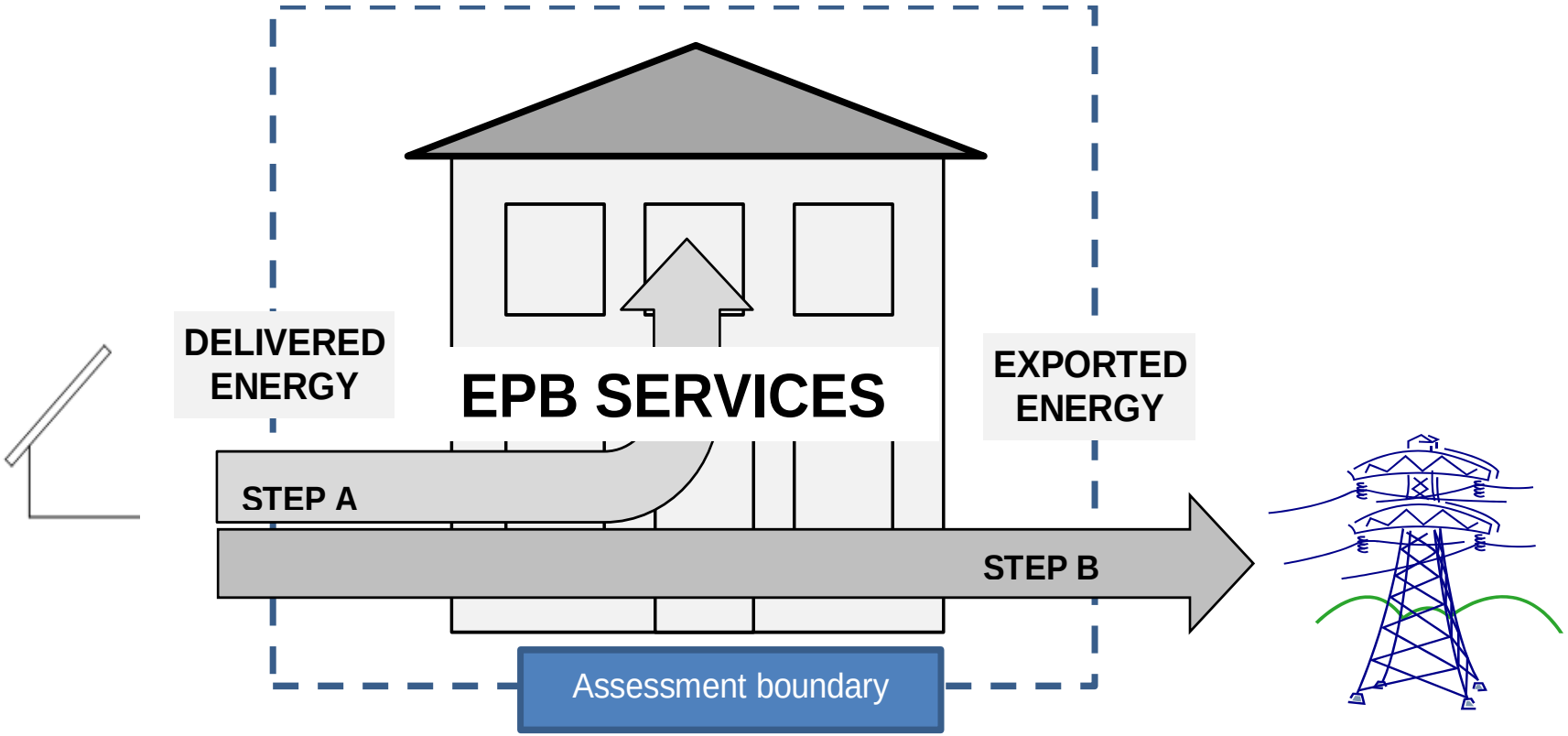


Imported and exported may be strongly unbalanced.

This happens independently for renewable and non renewable energy

$$E_P = E_{del} \cdot f_{P;del} - E_{\exp} \cdot f_{P;\exp}$$

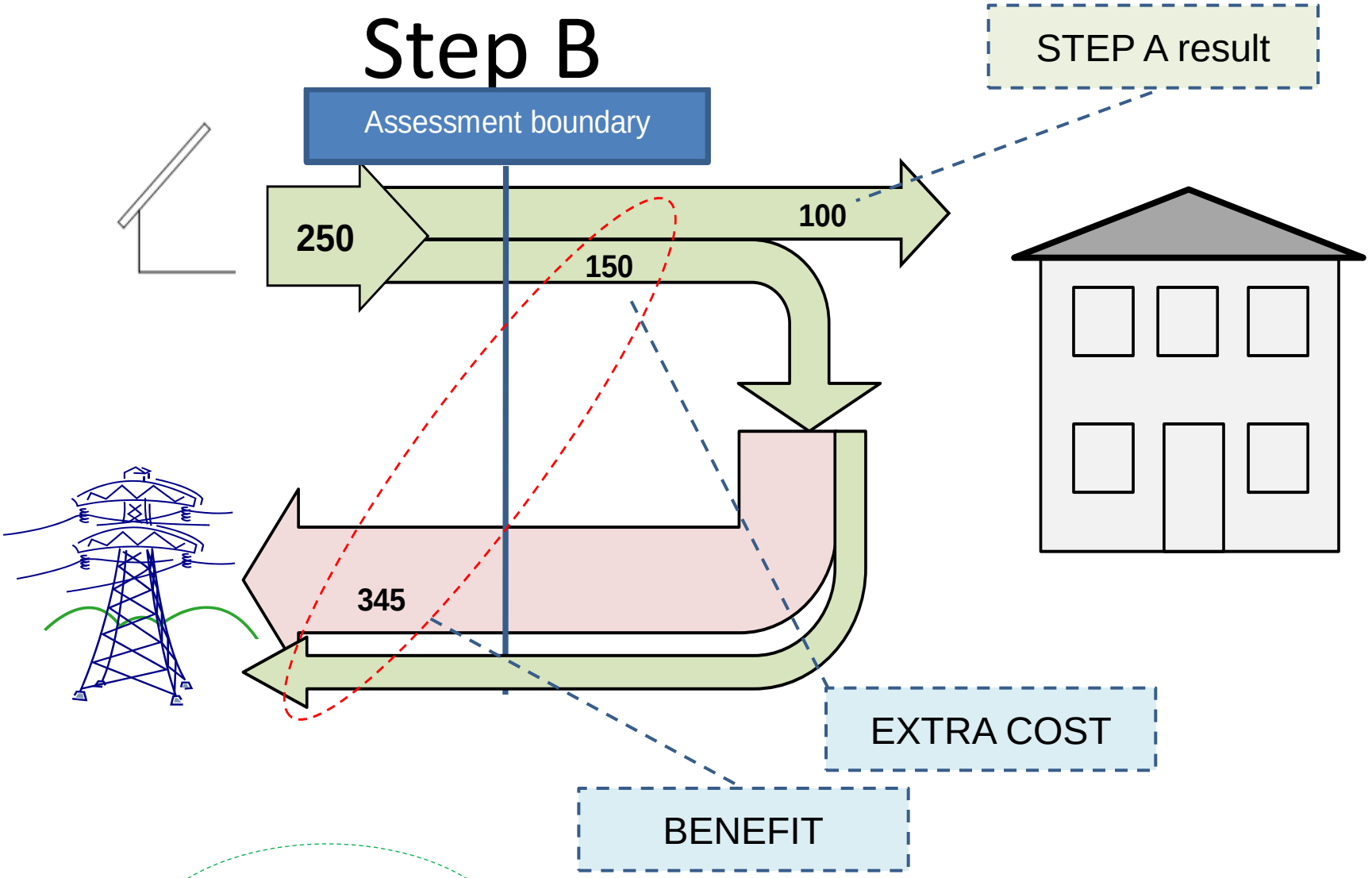
From A<>B to A → B



STEP A: determine the energy performance of the building taking into account only the delivered energy that is actually used to provide the desired EPB services;

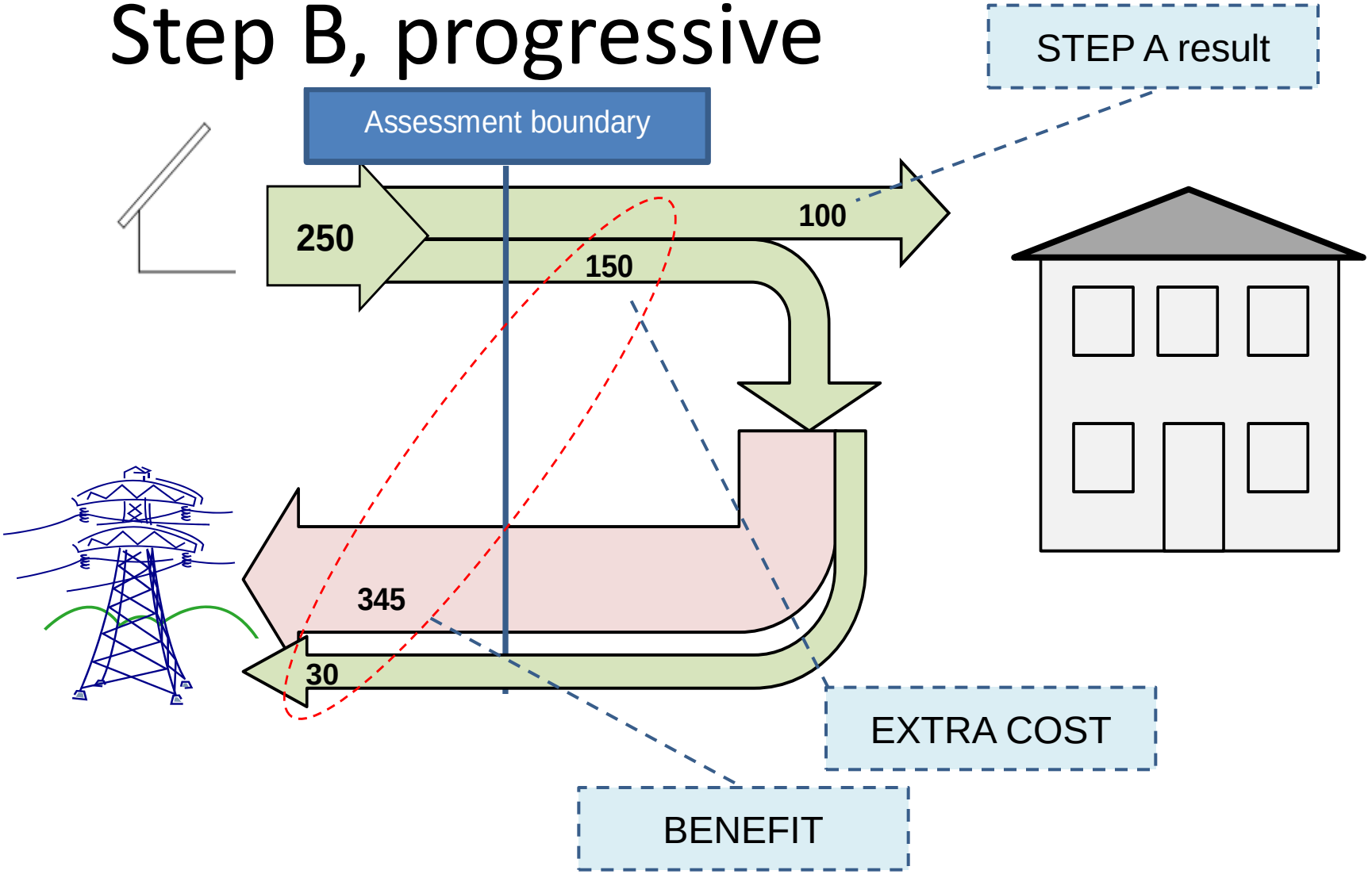
STEP B: include into the energy performance of the building the effect of the exported energy on the "external world".

Step B



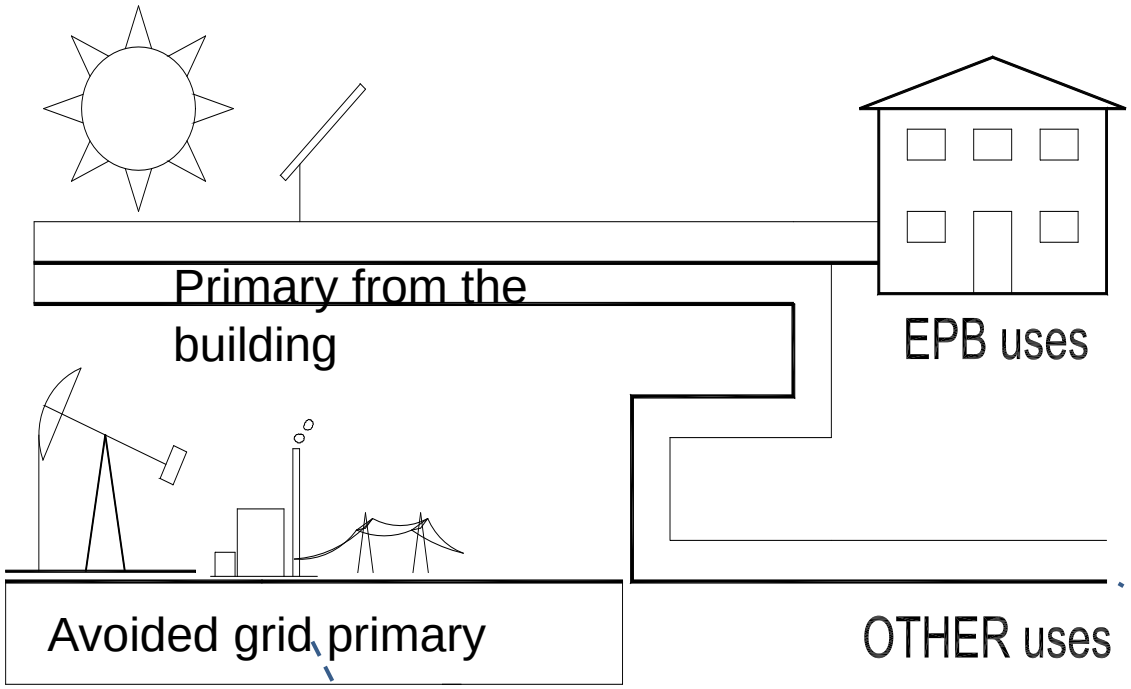
$$E_P = E_{del;A} \cdot f_{P;del;A} + E_{del;B} \cdot f_{P;del;B} - E_{\exp;B} \cdot f_{P;\exp;B}$$

Step B, progressive



$$E_P = E_{del;A} \cdot f_{P;del;A} + \left(E_{del;B} \cdot f_{P;del;B} - E_{\exp;B} \cdot f_{P;\exp;B}\right) \cdot k_{\exp;incl}$$

What does step B mean

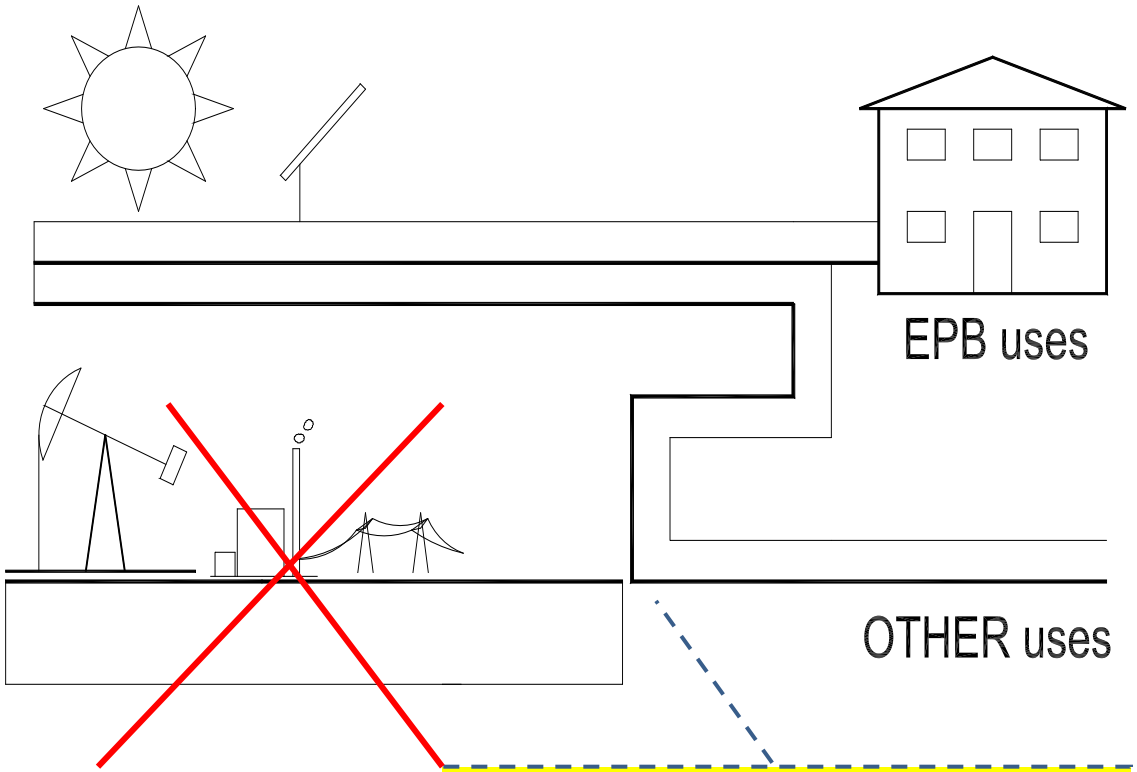


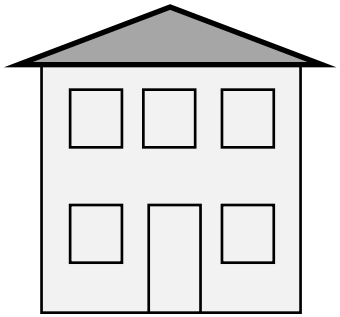
Primary energy factor of the grid shall be calculated without teh renewable energy from buildings otherwise double counting

The contribution to other (non EPB) uses is included

Not available for nearby buildings

So,

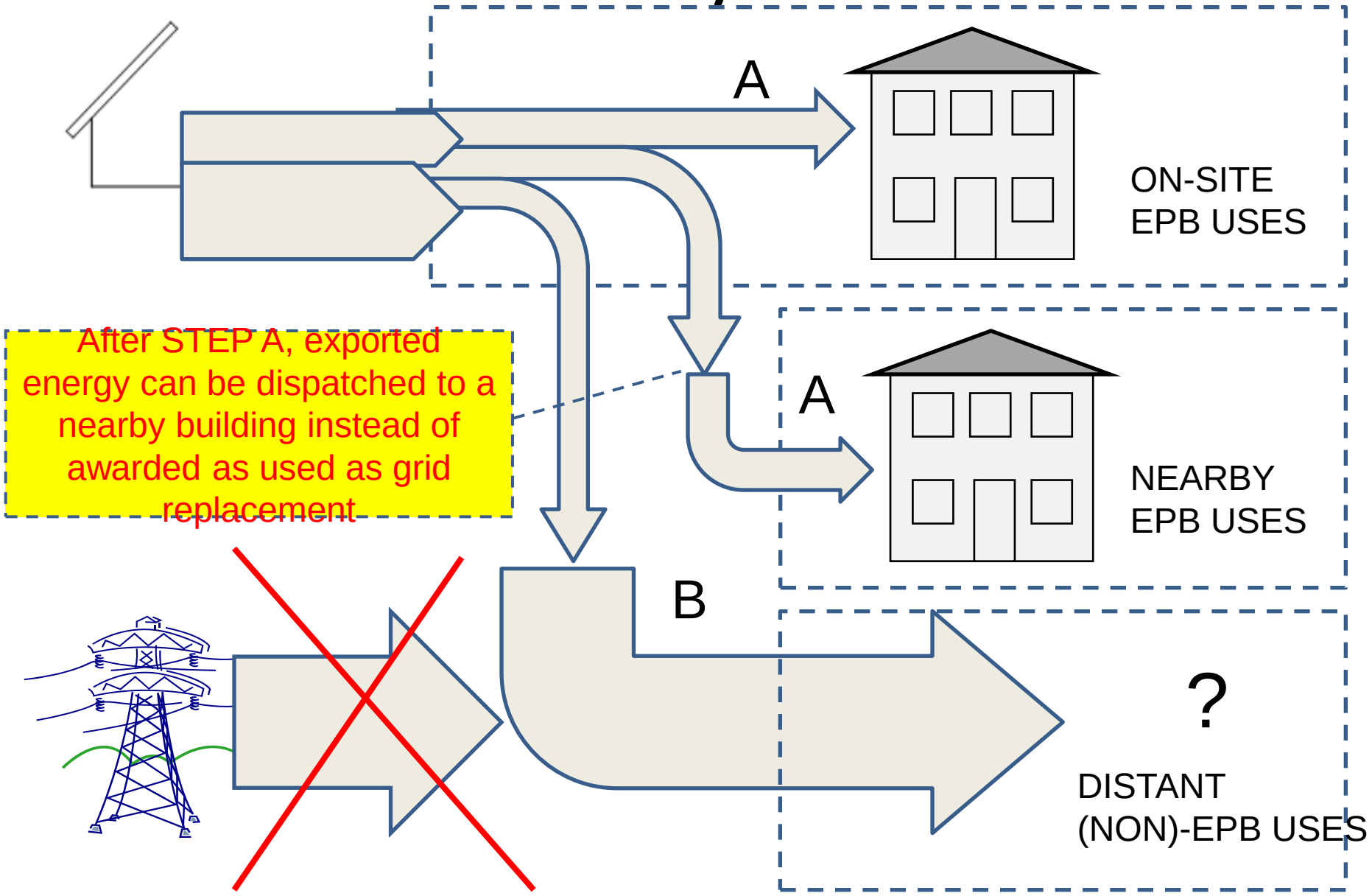




Nearby building

After STEP A, exported energy can be dispatched to a nearby building instead of awarded as used as grid replacement

Link with nearby and distant



Implications

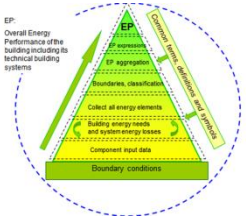
- It has to be specified how to allocate primary energy to each exported carrier
  - Simple for PV and similar
  - Old EN 15316-4-5 → new for CHP and others
- Priorities (or split) when many sources of exported carrier (PV + COGEN)

- Clear connection with on-site/nearby/distant concept
- Additional information on the energy use in building
- Explicit decision on exporte energy accounting (transparency)
- Possible additional hurdle for NZEB

Phase 2 of M480 project

- Project Phase 2 focusses on the improvement and expansion of the current set of CEN-EPB standards on the basis of the findings (CENSE reports, CAP-EDMC-LC reports etc.) and the set of requirements developed in phase 1 (the EN15603, TR, TS's and supporting information)
- The actual revision of the standards will be carried out under the responsibility of the relevant 5 CEN Technical Committees on the basis of this clear set of common principles and rules and priorities .

Work Program Phase 2



- About 100 Work Items
- Resulting in about 50 standards or parts thereof
- and about 50 Technical Reports connected to these standards
- Some WI's may still be merged , some TR's may cover more parts of a standard or more standards, this may shorten the list but not the work.
- For all standards an excel file has to be produced to report the input and output data and to verify the described calculation procedure and correct interconnection with referred standards

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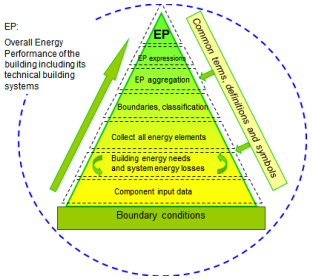
Planning Phase 2



- started July 2013
- The first drafts are ready
- May 2014 a draft prEN acceptance for enquiry
- October/November 2014 publication of the prEN's for enquiry
- It is expected to reach and possibly finish the enquiry stage of all EPB-standards around April 2015 (Keep in mind that **many** of the standards will not fundamentally change)
- Before the end of 2015 we expect all Enquiry comments to be resolved and Formal Vote versions ready .
- After publishing and voting we expect that during 2016 all EPB-standards will ready and available as EN (or EN-ISO) standards

Software tool to support the development and future use of the EPB-standards by software developers

- tool to support, to demonstrate and validate
  - the consistency and unambiguity of equations in the set of EPB-standards and
  - their interconnecting procedures: all in- and output files of the EPB standards will clearly be defined by these excel-sheets
- tool to facilitate the software developers to interpret the calculation procedures given in the various standards in a correct way

ECO-DESIGN Directive : M495

- ECO-DESIGN Directive and related Mandate 495 to CEN: is related to (as first priority energy using) product standards
- In developing the EPB system standards we have to communicate with the relevant product TC's on:
  - requirements on product performance data needed for the EPB system descriptions
  - At the same moment convince the product TC's to refer to our system standards when assessing the declared Energy Performance on the ECO-label

Central coordination within CEN by small team of Task Leaders/experts in CEN TC 371-CAP

- CEN TC 371 organises this central coordination team in cooperation with the other relevant CEN TC's
- Regular report to the 5 TC's and TC371
- Project Teams on different clusters, related to the five CEN TC's:
  - CEN TC 89, Thermal performance of buildings and building components: Core Team-leader Dick van Dijk (NL)
  - CEN TC 228, Heating systems in buildings: Core Team-leader Johann Zirngibl (F)
  - CEN TC 156, Ventilation for buildings: Core Team-leader Gerhard Zweifel (CH)
  - CEN TC 247, Controls for mechanical building services: Core Team-leader Dan Napar (F)
  - CEN TC 169, Light and lighting: Core Team-Leader Sohéil Moghtader & Jan de Boer (D)

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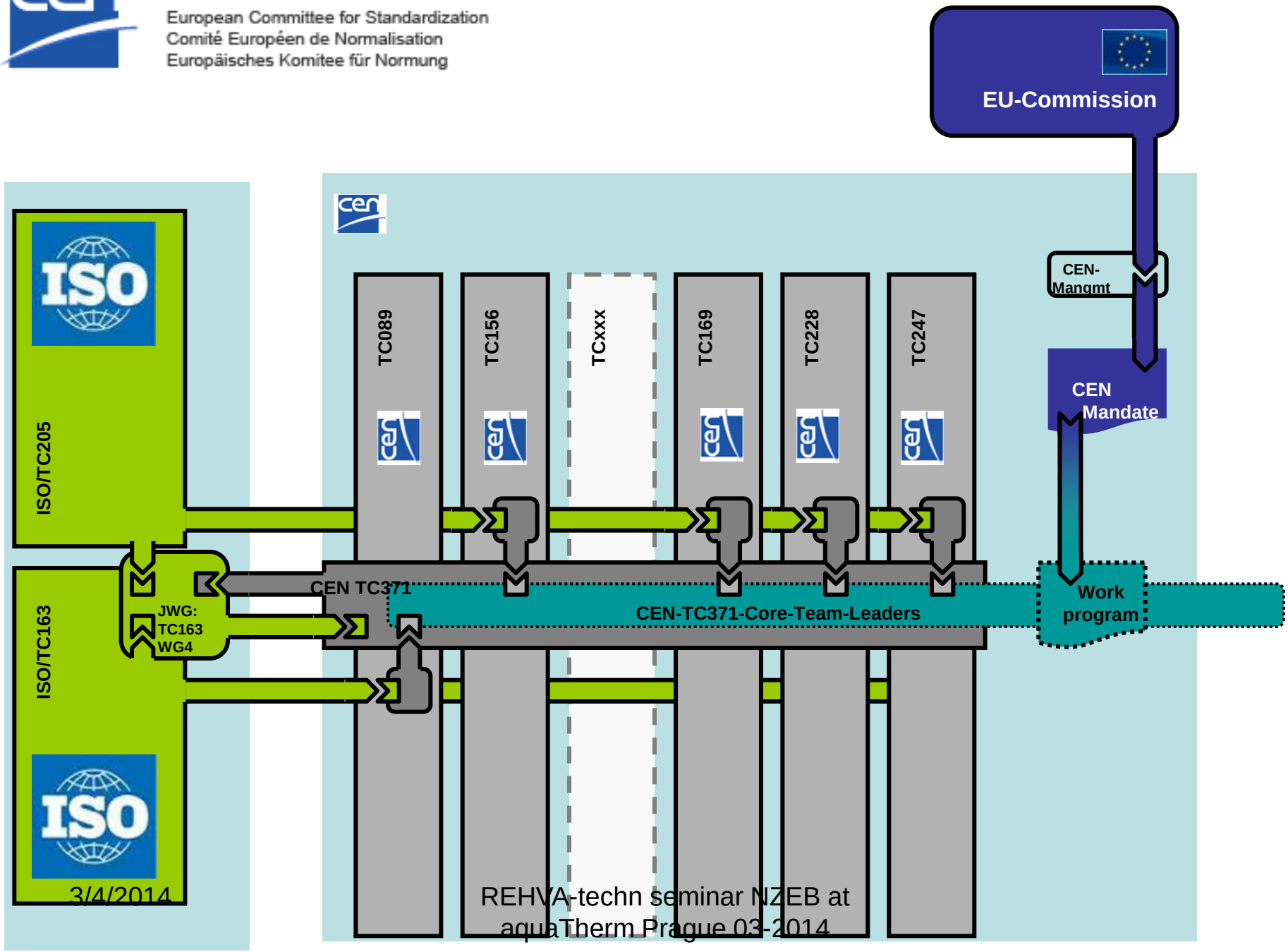

The CEN ISO interaction

- An active process of interaction
- Sharing early prelim draft texts
- Sharing experts in the ISO and CEN teams working on these standards
- With the ultimate goal to agree on ISO standards
- A challenge given the geographic and other differences in the building sector and the very tight time scale.