

# edilportale<sup>®</sup>

## TOUR 2017

Ristrutturazione, riqualificazione  
energetica, comfort abitativo,  
adeguamento antisismico, BIM



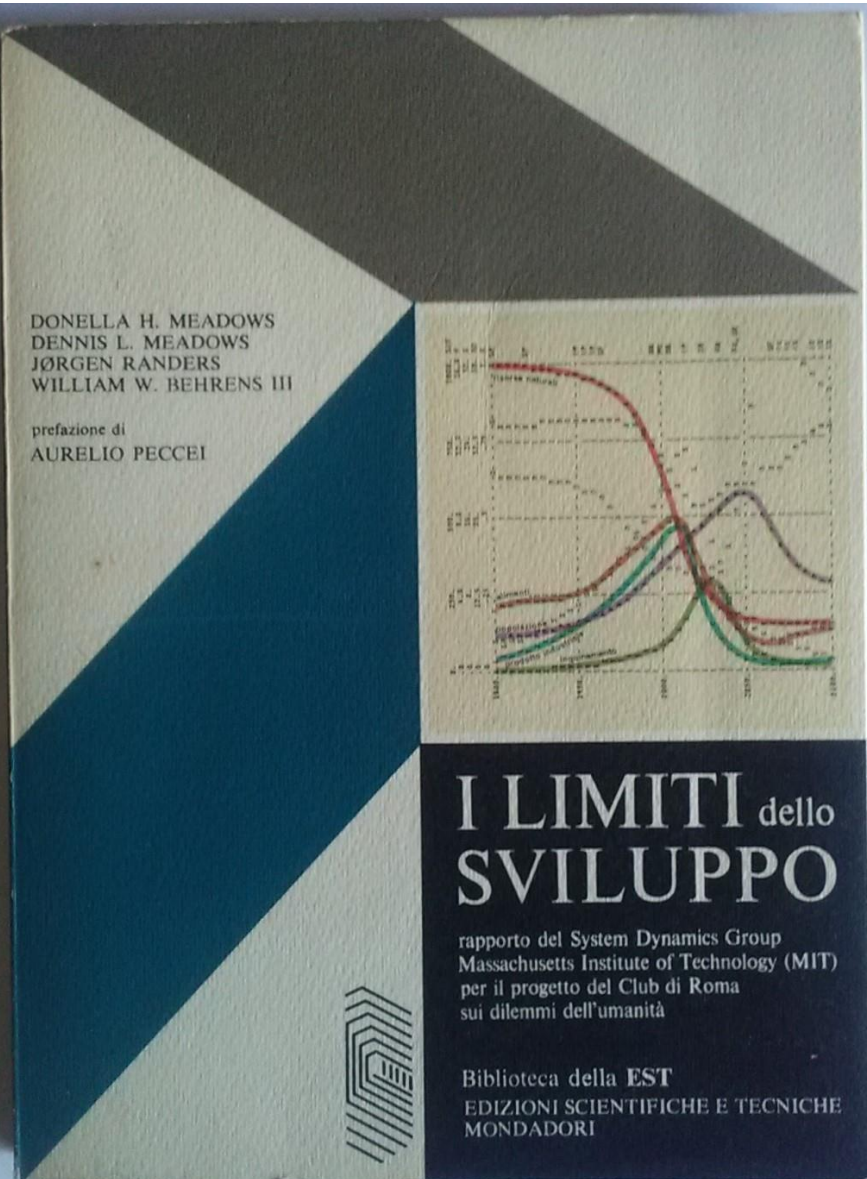
Roofingreen



**Bologna, 11 maggio 2017**

**Riqualificazione e certificazione energetica degli edifici:  
stato dell'arte, opportunità e controlli**

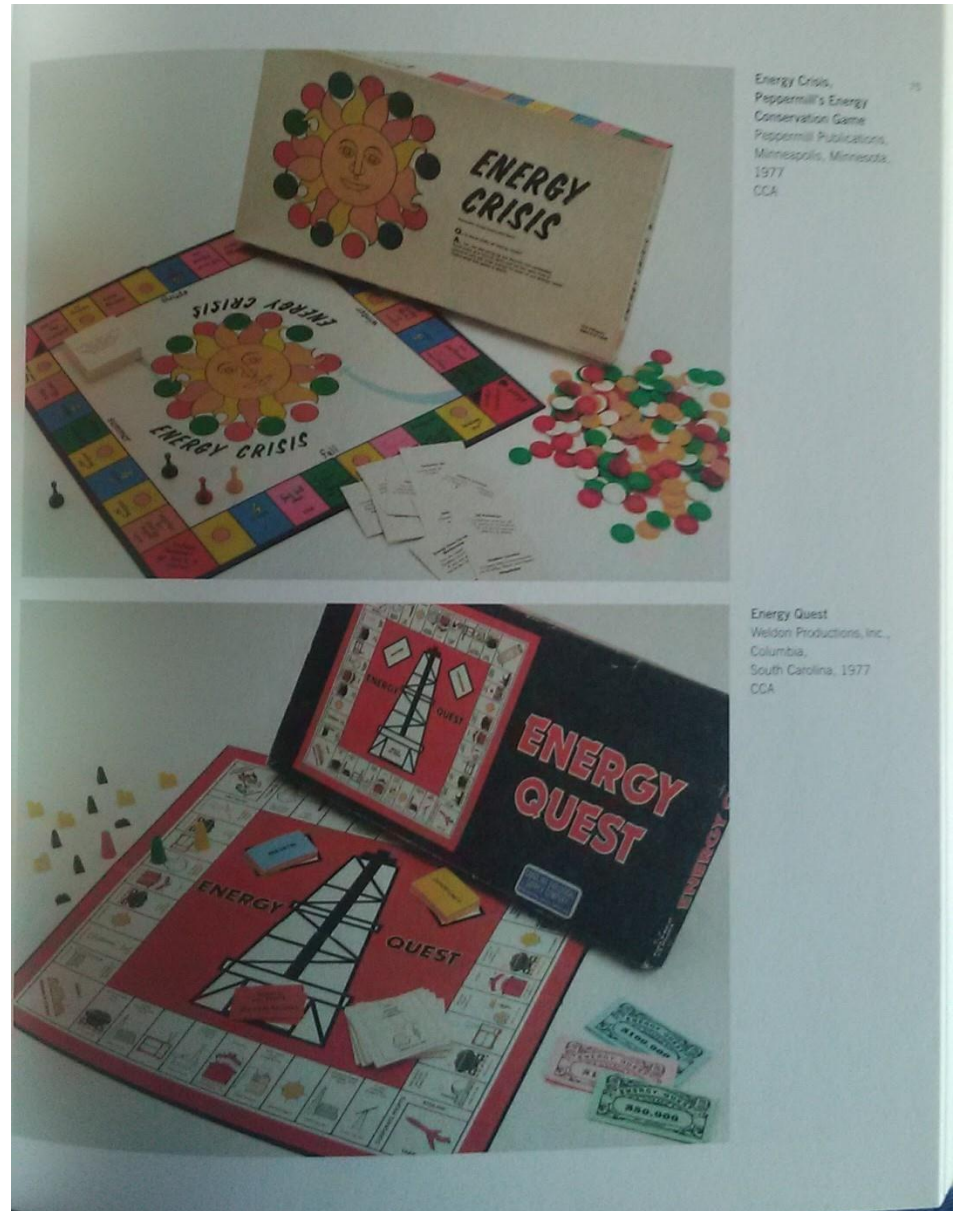
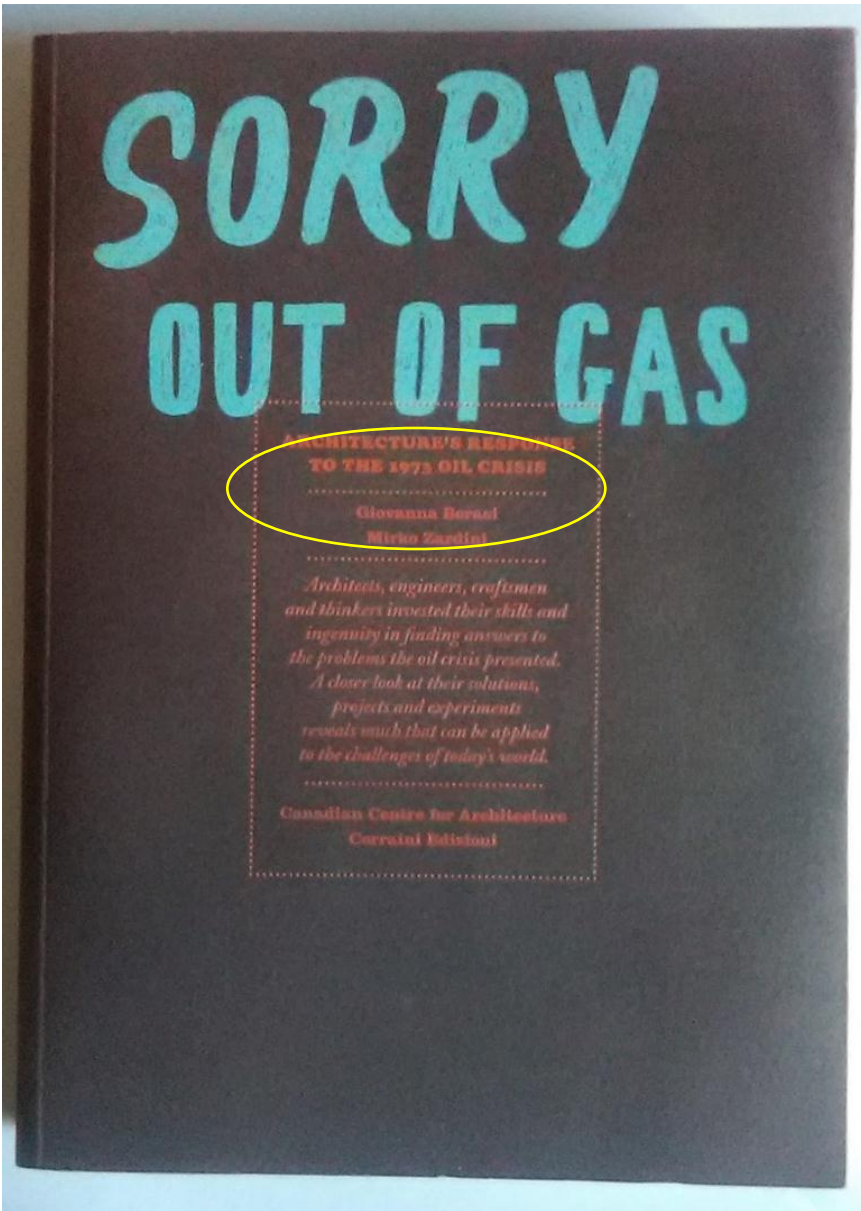
**Kristian Fabbri**



Il dibattito aperto da questo rapporto, anche se utile a innescare questo movimento in forma razionale, ed evitare possibilmente il precipitare di una crisi senza sbocchi, non è che una fase di un processo che deve andare assai più in profondità. Il guasto infatti è profondo, alle radici medesime del nostro tipo di civiltà. Ricerche più avanzate, autocritiche genuine, meditazioni più penetranti saranno necessarie. Se avremo la forza morale per intraprenderle, non solo potremo sperare di correggere il corso degli eventi per evitare il peggio che già si profila per un non lontano futuro, ma potremo forse gettare le basi di una nuova grande avventura dell'uomo, la prima a dimensioni planetarie, quali le sue conoscenze e i suoi mezzi tecnico-scientifici oggi non solo permettono, ma ormai impongono.

Roma, maggio 1972

AURELIO PECCEI



HISTORY

# Jencks's theory of evolution

*an overview of twentieth-century architecture*

At the start of the twenty-first century, Charles Jencks gives a personal, perceptive and provocative summary of the architecture of the twentieth. Many will disagree with his narratives and emphases, particularly perhaps with his choice of Gaudi as the architect of the century, but now, as Jencks says, 'interpretation begins'.

Now that the century is over it is time to ask what it meant for architecture. This is a harder question than it first appears. Did Modern architecture, as its apologists claim, triumph over other contenders? What was the relationship of commercial practice to quality – did the best architects lead or only influence the profession? Did good architecture trickle-down or was it dumbed-down? Or did a hundred mini-movements tell the real story of the century; or was it like that of the past, one of spec builders, the DIY industry and self-build? In terms of sheer numbers the century has been claimed for the shed building, the factory, warehouse and its cousin, the office. In terms of cost airports have won, in terms of prestige museums, in terms of kitsch it has been shopping and mega-malls, but building-counts like body-counts only tell the background story.

The main narrative does not belong to any building type, movement, individual or sector. Rather, it belongs to a competitive drama, a dynamic and turbulent flow of ideas, social movements, technical forces and individuals all jockeying for position. Sometimes, a movement or an individual may be momentarily in the public eye and enjoy media power, but such notoriety rarely lasts for more than five years and usually for not more than two. It is true that certain architects of the previous century – how strange those words ring for Modernists – were creative forces that lasted for longer. Mies was a power to be reckoned with in the '20s and '60s. Le Corbusier, Frank Lloyd Wright and Aalto, who with Mies made up the big four, were seminal at more times and Kahn, Stirling, Eisenman and Gehry, the little four, each had two small periods of influence. But even these protean characters, in order to stay relevant and on top, had to reinvent themselves about every 10 years.

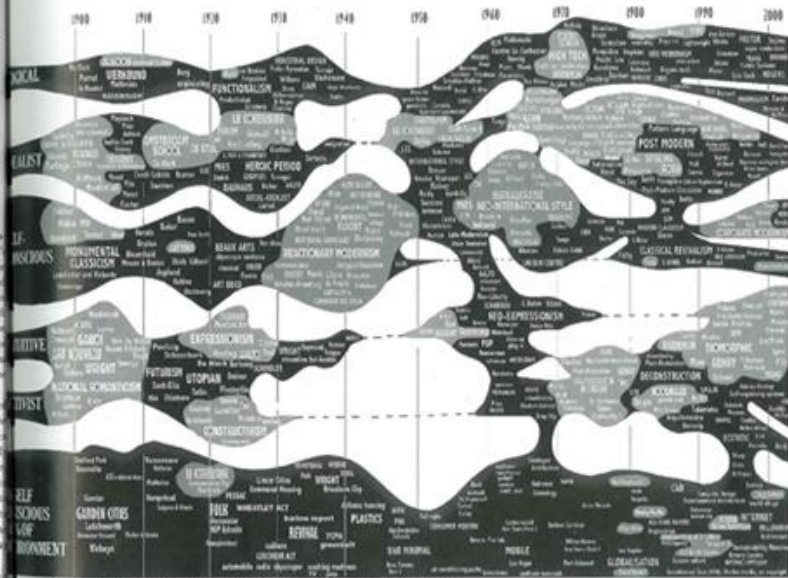
The notion that there is a '10-year rule' of reinvention for the creative genius in the twentieth century has been well argued by the Harvard cognitive scientist Howard Gardner in his book *Creating Minds*, 1993. Subtitled *An anatomy of creativity seen through the lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham and Gandhi*, it is a detailed study of these, the big seven Modernists, and it shows how they often made breakthroughs or underwent creative shifts every 10 years. In a recently finished book, *Le Corbusier and the Continual Revolution in Architecture*, I have found the same pattern in this Proteus of design. As the Hayward Gallery put it, polemically, in the title of a 1987 retrospective Le Corbusier was 'The Architect of the Century'. Well, could this be possible – even before the century was over and Frank Gehry given a shot at the title? I

think the answer is 'yes', as I argue at length and as the accompanying evolutionary tree, or diagram, shows. One will find Corbusier present on this chart at five different points: as the leader of 'the Heroic Period' of the 1920s; as a leading thinker of a new (and rather unfortunate) urbanism; as the leader of CIAM and mass housing after the war; as a harbinger of Post-Modernism with Ronchamp and his symbolic architecture of Chandigarh; and, just at the end of his life, with his Brussels and Zurich pavilions, the forerunner of the High-Tech movement. No other architect was as creative in different traditions; not for nothing was he seen as 'the Picasso of architecture'.

But the point of my argument is slightly different than Howard Gardner's. While agreeing with his analysis, I think one of the important reasons for the demonic creativity of these seven 'geniuses' is that the last century was uncommonly turbulent. My diagram, and its intusio blob, captures this continual revolution. At any one time the twentieth century architect has had to face three or four competing movements of architecture, respond to changes in technology, social forces, style and ideology – not to mention world wars and such large impersonal forces as the Internet. It was an exhausting century. As the Chinese say: 'may you be condemned to live in interesting times'.

However beneficent this may be for architectural creativity this has not been healthy or good for the environment. For one thing there has been Gardner's message – the revolutionary period has been dominated by men, there are very few women among the 400 protean creators I have gathered from other writers. An urbanism both more feminine and coherent would have been far superior to the over-rationalized and badly related boxes that have formed our cities. For another thing continual revolution, or the constant change of fashion, business cycles, technical innovation and social transformation has meant that architecture, like the other arts, lacks depth and perfection. It is hard to master an art when surfing a waterfall. Nonetheless, that is what the old century has been, a turbulent motion of whirls and eddies; sometime even the whirlpool of Fascist and Nazi architecture going nowhere but down. There are about 100 trends and technical forces shown, and 60 movements, many of them 'isms' – Futurism, Parisian Expressionism, Brutalism or Metabolism – that became 'waxes' Riding these waves as a leader is exhilarating, until the Neo-follower surfs on by.

I don't mean to be disparaging so much as realistic. The twentieth century produced great architecture but, as Lewis Mumford



Jencks's 'The Century is Over, Evolutionary Tree of Twentieth-Century Architecture' with its attractor basin.

when asked, with great faults. A critical Modernism, or Post-Modern perspective, must acknowledge these deep problems and face the horrors of the century as much as the triumphs.

### The evolutionary tree and its surprising conclusions

Usually when historians look at the recent past they do so with the eyes and taste that rigidly exclude the variety, contradictions, mess and creative wealth of a period, and we applaud them for so doing. All history writing is selective and based on theories of what really matters, and there is no way around this limitation. But there are ways to compensate for perspectival distortion and over the last 30 years I have devised a method, the evolutionary tree, which if it is not completely inclusive is at least balanced in its selective effects.

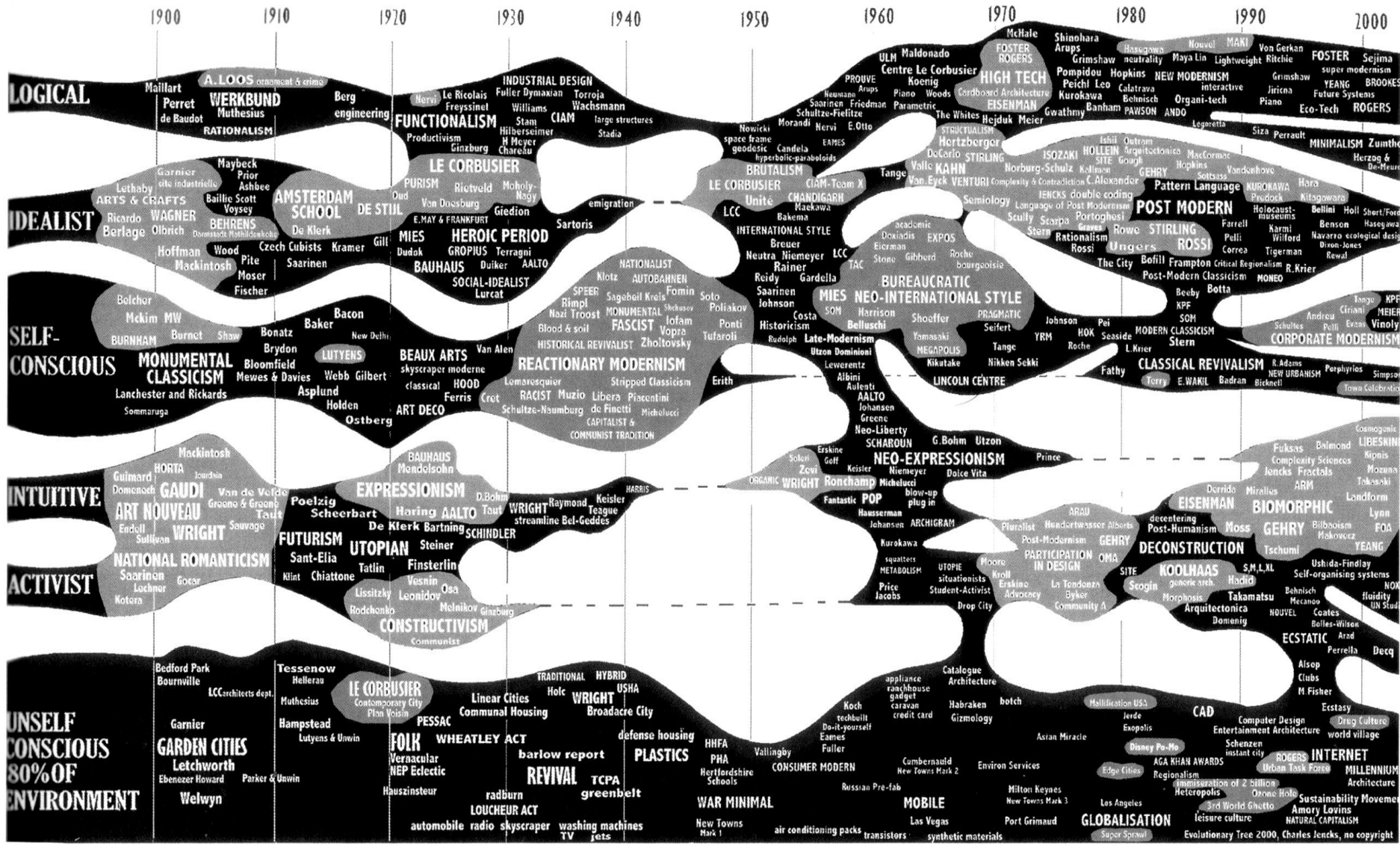
As can be seen in the classifiers to the extreme left of the diagram, it is based on the assumption that there are coherent traditions that tend to self-organise around underlying structures. These deep structures, often opposed to each other psychologically and cultur-

ally, act like what are called, in the esoteric science of nonlinear dynamics, 'attractor basins'. They attract architects to one line of development rather than another? Why? Not only because of taste, training, education and friendships, but because of type-casting and the way the market forces architects to have an identifiable style and skill. In a word, specialisation.

Of course, architects dislike being pigeon-holed as much as do politicians and writers – they too like to claim universality, freedom and openness. But it is the rare architect, such as Le Corbusier or Gehry, who can be found in several different traditions and often they are pilloried for leaving one fold for another. Enough forces conspire to keep the architect 'on message', even when they seek, like Post-Modernism, to be pluralistic.

What stories does this turbulent blob-diagram tell? In crude terms it reveals some surprises. Most architecture – 80 per cent – is by non-architects, or at least the result of larger processes that are, artistically speaking, unconscious: building regulations,

Quale architettura ?



Evolutionary Tree 2000, Charles Jencks, no copyright

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DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL  
of 19 May 2010  
on the energy performance of buildings  
(recast)

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DIRETTIVA 2010/31/UE DEL PARLAMENTO EUROPEO E DEL CONSIGLIO  
del 19 maggio 2010  
sulla prestazione energetica nell'edilizia  
(rifusione)

PREMESSA

**3) Gli edifici sono responsabili del 40 % del consumo globale di energia nell'Unione.** Il settore è in espansione, e ciò è destinato ad aumentarne il consumo energetico. Pertanto, la riduzione del consumo energetico e l'utilizzo di energia da fonti rinnovabili nel settore dell'edilizia costituiscono misure importanti necessarie per ridurre la dipendenza energetica dell'Unione e le emissioni di gas a effetto serra. Unitamente ad un maggior utilizzo di energia da fonti rinnovabili, le misure adottate per ridurre il consumo di energia nell'Unione consentirebbero a quest'ultima di conformarsi al protocollo di Kyoto allegato alla convenzione quadro delle Nazioni Unite sui cambiamenti climatici (UNFCCC) **e di rispettare sia l'impegno a lungo termine di mantenere l'aumento della temperatura globale al di sotto di 2 °C, sia l'impegno di ridurre entro il 2020 le emissioni globali di gas a effetto serra di almeno il 20 % al di sotto dei livelli del 1990** e del 30 % qualora venga raggiunto un accordo internazionale. La riduzione del consumo energetico e il maggior utilizzo di energia da fonti rinnovabili rappresentano inoltre strumenti importanti per promuovere la sicurezza dell'approvvigionamento energetico e gli sviluppi tecnologici e per creare posti di lavoro e sviluppo regionale, in particolare nelle zone rurali.



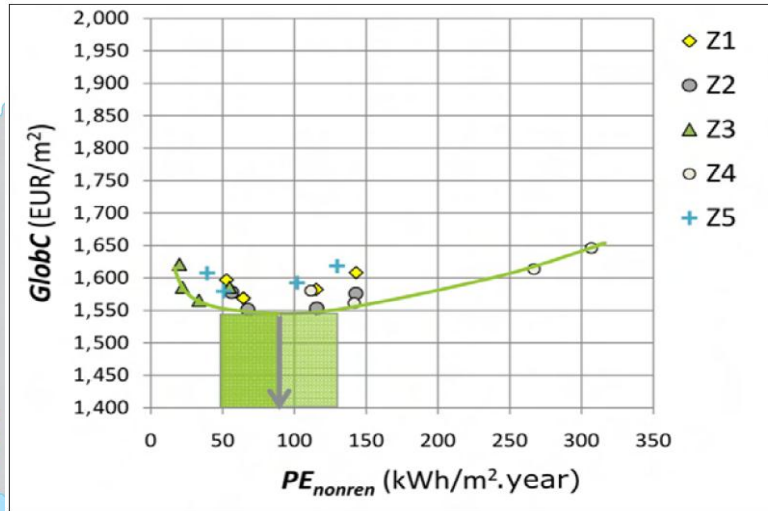
2016

Implementing  
the Energy Performance  
of Buildings Directive (EPBD)

FEATURING COUNTRY REPORTS



www.epbd-ca.eu



### 3.2 Calculating costoptimal energy performance levels

The EPBD requires MSs to report on the comparison between their legal minimum energy performance requirements and calculated cost-optimal levels using the comparative methodology framework.

(...)

> **Establish at least nine reference buildings** – one for new buildings and two for existing buildings subject to major renovation, for single-family, multi-family, and office buildings respectively. In addition to office buildings, MSs must establish reference buildings for other non-residential building types for which energy performance requirements exist, e.g., educational buildings, hospitals, hotels and restaurants, sports facilities, wholesale and retail trade services buildings, and other types of energy consuming buildings. Several building types can be represented by the same reference building type, e.g., hotels and prisons, or offices and universities, if appropriate.

> **Define packages of energy efficiency measures** to be applied to these reference buildings.

> **Assess the primary and final energy needs of the reference buildings** and the impact of the applied improvement measures.

> **Calculate the life cycle cost of the building after energy efficiency measures** are implemented, by applying the principles outlined in the comparative methodology framework.

nearl ZERO-ENERGY Buildings



The discussion topics included the different national applications of the NZEB definition, the most common building and service system solutions, calculation methods, supporting documents (e.g., guidelines), awareness raising activities for the general public, subsidies and other available incentives and support policies, etc.

A particularly important objective has been the integration of Renewable Energy Sources (RES) into the NZEB national implementation. This is part of the EPBD requirements, as the nearly zero or very low amount of energy consumed in NZEBs should be covered to a very significant extent by energy from renewable sources, but it also links to the RES requirements from Directive 2009/28/EC.

2016

Implementing the Energy Performance of Buildings Directive

FEATURING COUNTRY REPORTS

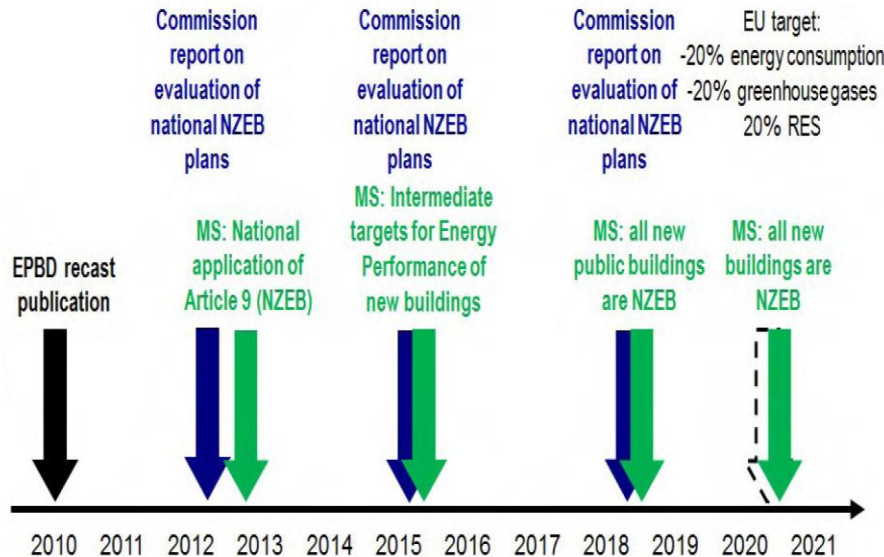
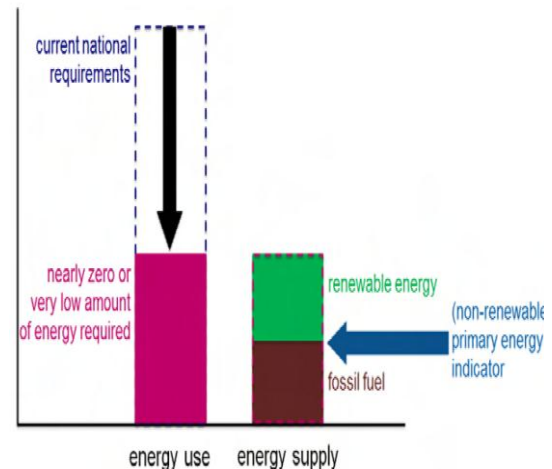


Figure 3: Graphical interpretation of the NZEB definition according to Articles 2 and 9 of the EPBD.





**near ZERO-ENERGY  
Buildings**

Country	Main points of the NZEB definition				
	Detailed definition	Very high energy performance	Nearly zero or very low amount of energy required Limits placed on:	Very significant extent of renewable energy	Primary energy indicator in kWh/m <sup>2</sup> .year
Denmark	Included in BR10, currently voluntary, to be adjusted	Building class 2020 (75% reduced to 2006)	20 kWh/m <sup>2</sup> .year (for dwellings) / 25 kWh/m <sup>2</sup> .year (for other buildings) primary energy	Indirect *, examples of solar panel sizes necessary to cover deficiencies in combination with district heating/heat pump in national plan	Yes
Estonia	Included in regulation VV No 68:2012 "Energiatõhususe miinimumnõuded"	Building class A	Primary energy: 50 kWh/m <sup>2</sup> .year (for single-family houses) / 270 kWh/m <sup>2</sup> .year (for hospitals)	Indirect *	Yes
Finland	The detailed definition will be finalised in the course of 2015 and the aim is to present the legislative proposal to the parliament in autumn 2016	-	-	-	-
France	Included in RT 2012	1/3 of prior requirements	50 kWh/m <sup>2</sup> .year primary energy	Direct: 5-12 kWh/m <sup>2</sup> .year for single- and multi-family houses, more in RT 2020	Yes
Germany	EPBD text implemented in energy saving act, detailed definition is being developed	Probably along KfW efficiency houses	Probably mean U-value of the building envelope and primary energy	Direct requirements included in current minimum energy performance requirements	Requirements included in current minimum energy performance
Greece	EPBD text implemented in Law 4122/2013 of 19 February 2013	-	-	Direct requirements included in current minimum energy performance requirements	Requirements included in current minimum energy performance
Hungary	Draft definition included in Decree about Determination of Energy Efficiency of Buildings of 7/2006 (V.24), detailed definition is being developed	More efficient than cost-optimal level	Specific heat loss coefficient of the building envelope, primary energy	Direct requirements included in current minimum energy performance requirements	Yes

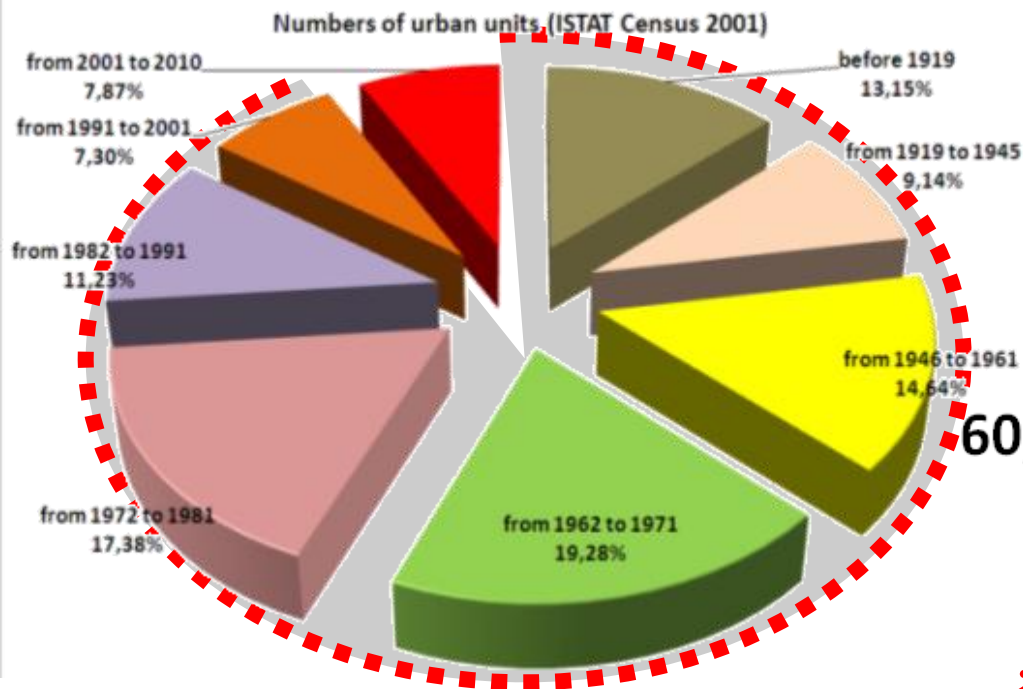
25 kWh/m<sup>2</sup>a

50 kWh/m<sup>2</sup>a

Country	Main points of the NZEB definition				
	Detailed definition	Very high energy performance	Nearly zero or very low amount of energy required; Limits placed on:	Very significant extent of renewable energy	Primary energy indicator in kWh/m <sup>2</sup> .year
Italy	EPBD text in Decree Law no. 63/90 of 2013, new energy decree includes detailed definition near completion	Primary energy significantly lower than current requirements (e.g., 60% tightening for a small multi-family building near Milano)	Primary energy for heating, primary energy for cooling, total primary energy	Direct: planned for NZEB is 50% of primary energy (direct requirements included in current minimum energy performance requirements)	Yes

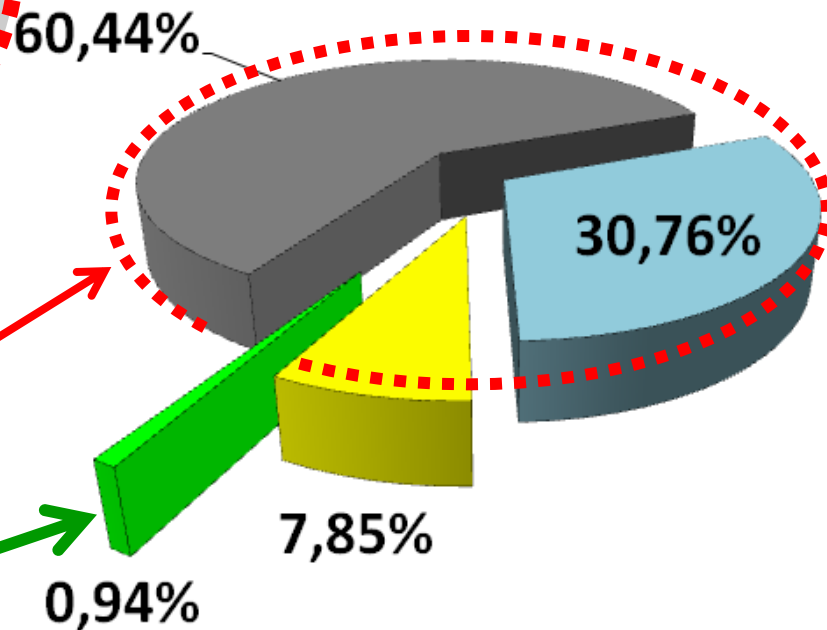
50 % FER

**Caratteristiche del patrimonio edilizio italiano**



**Patrimonio edilizio unità abitative**

- Costruite prima del 1971
- dal 1971 al 1991
- dal 1991 al 2008
- nuove unità/anno

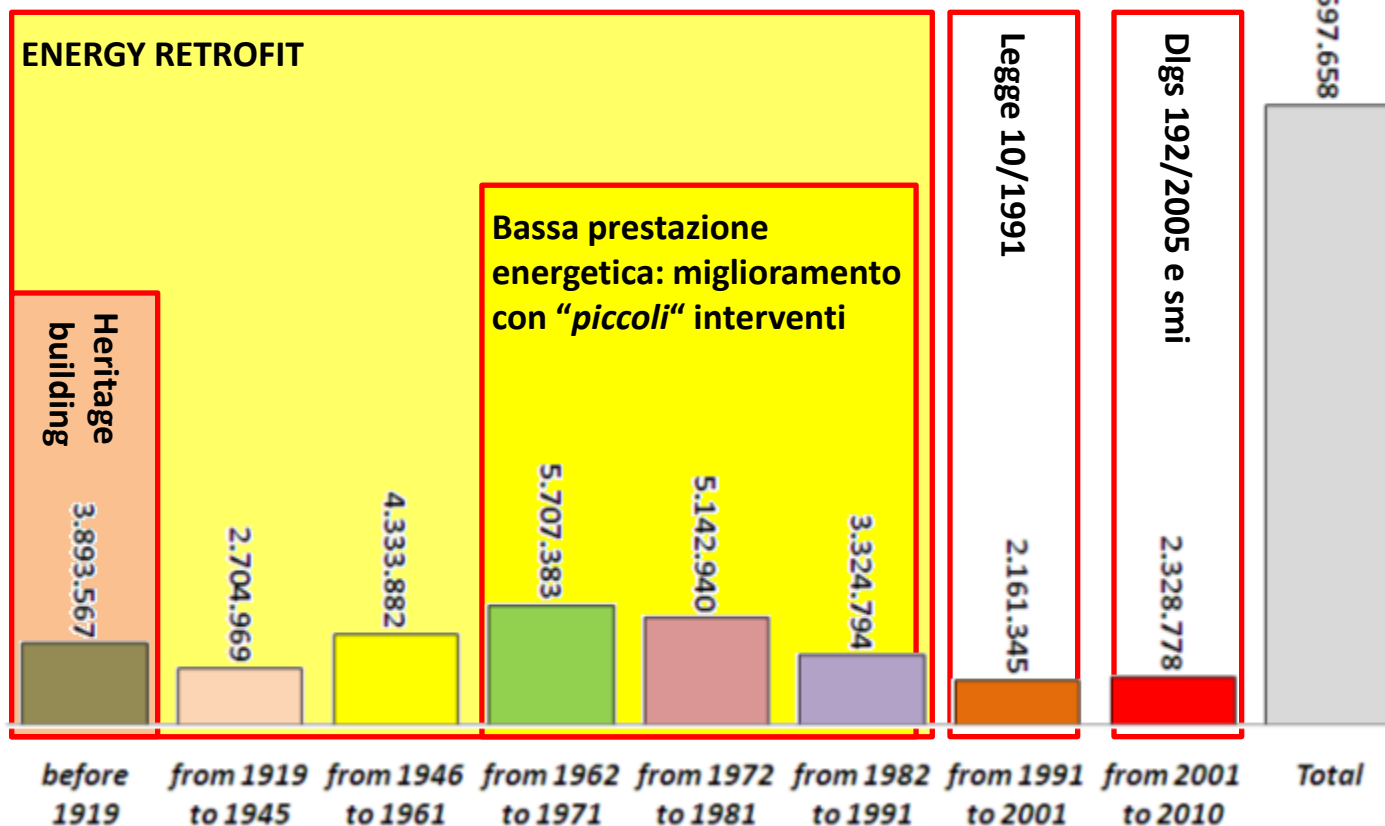


**Riqualificazione energetica**

**Edifici ad energia quasi zero**

**Caratteristiche del patrimonio edilizio italiano**

Numbers of urban units (ISTAT Census 2001)



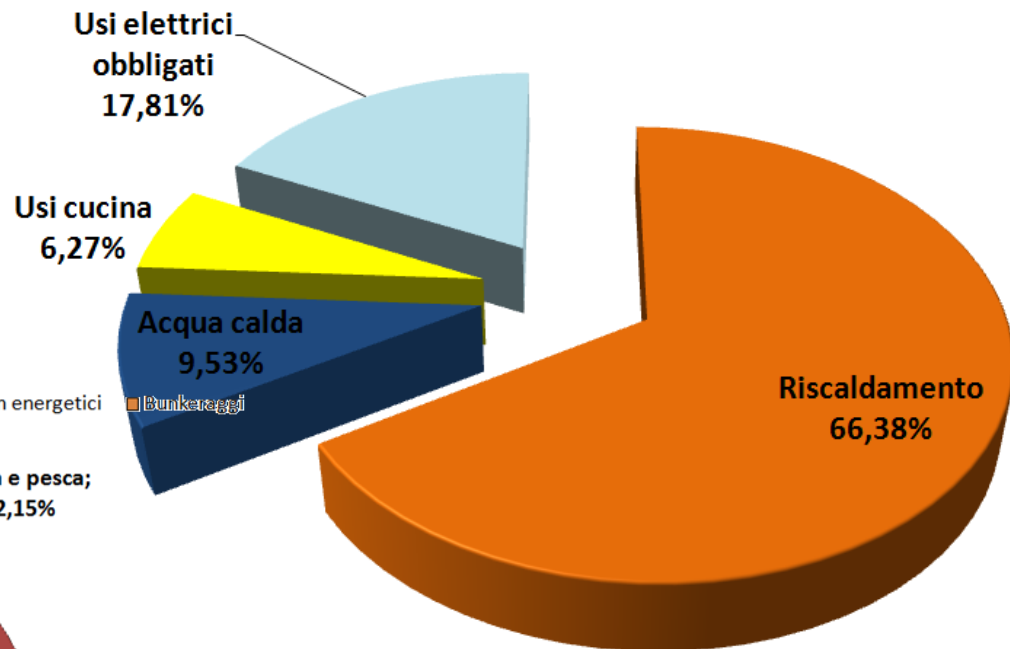
**Patrimonio edilizio residenziali suddiviso per periodo di costruzione**

## Caratteristiche del patrimonio edilizio italiano

### Consumi energetici

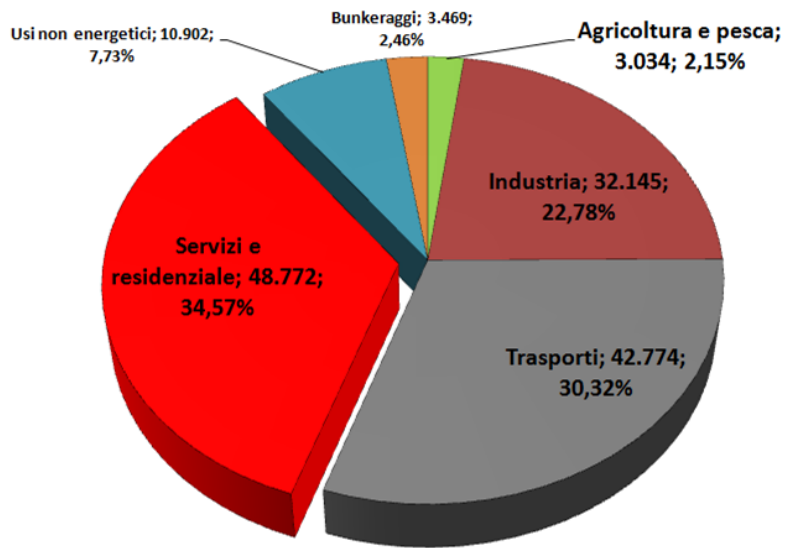
#### Usi energetici residenza

■ Riscaldamento   
 ■ Acqua calda   
 ■ Usi cucina   
 ■ Usi elettrici obbligati



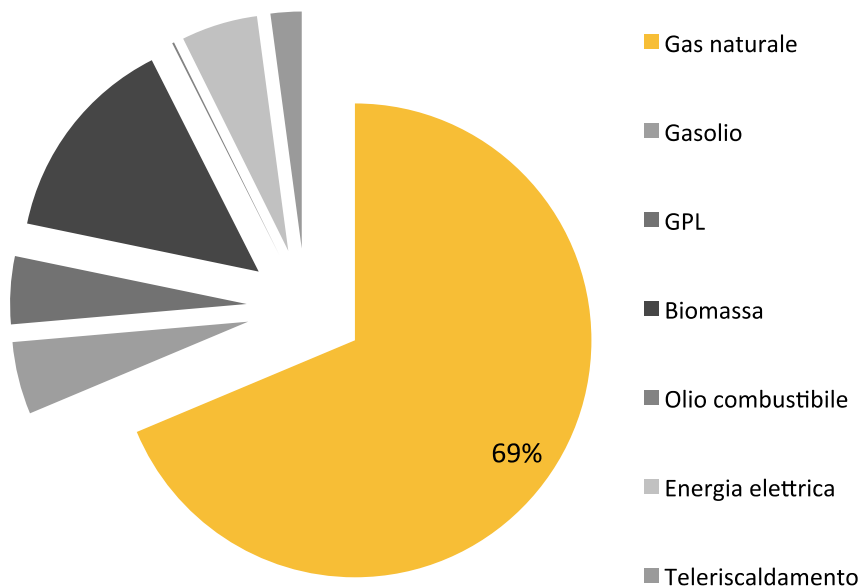
#### Consumi totali (ktep) 2010

■ Agricoltura e pesca   
 ■ Industria   
 ■ Trasporti   
 ■ Servizi e residenziale   
 ■ Usi non energetici   
 ■ Bunkeraggi



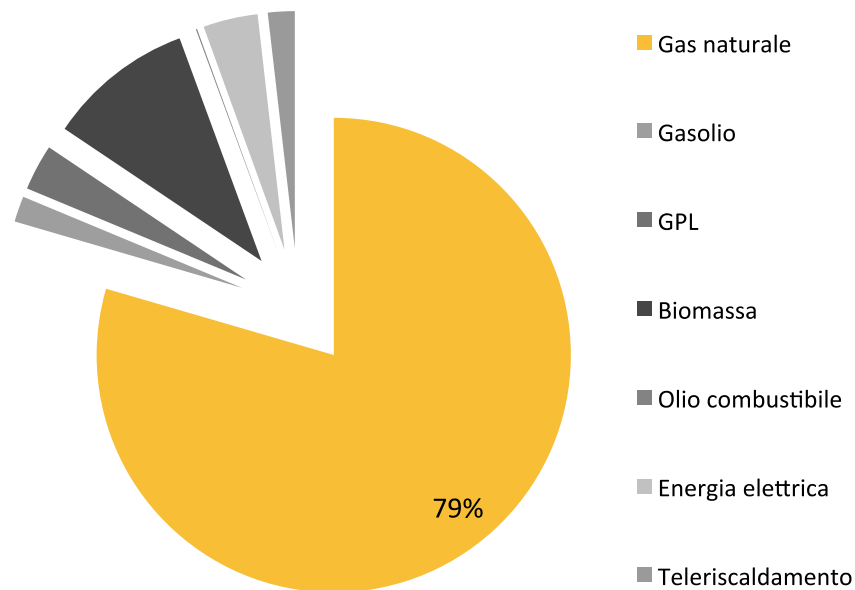
## Caratteristiche del patrimonio edilizio italiano

Combustibile di alimentazione dell'impianto di riscaldamento in abitazioni occupate in Italia



Fonte: elaborazioni ERVET su dati ISTAT

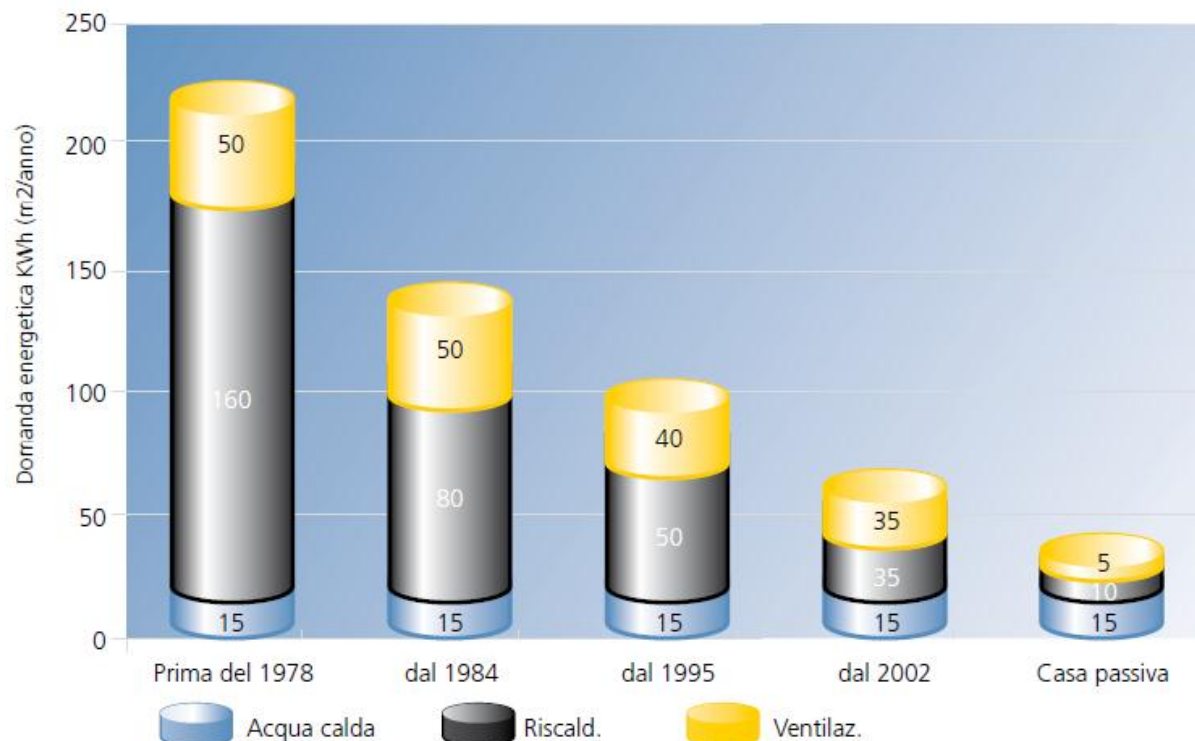
Combustibile di alimentazione dell'impianto di riscaldamento in abitazioni occupate in Emilia-Romagna



Fonte: elaborazioni ERVET su dati ISTAT

## Prestazione Energetica: Energia PRIMARIA REN e NREN

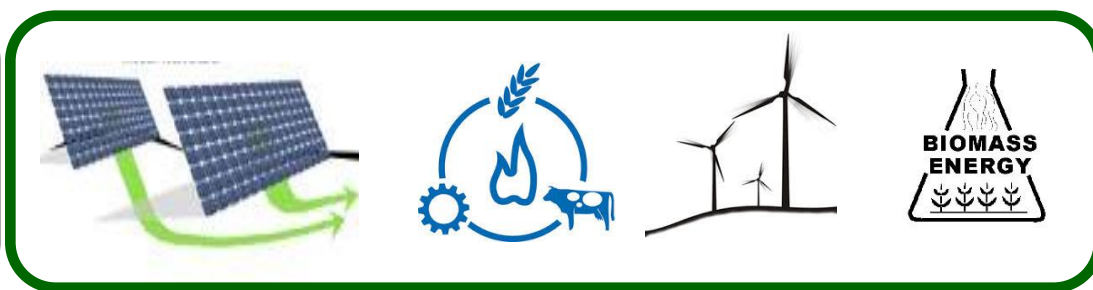
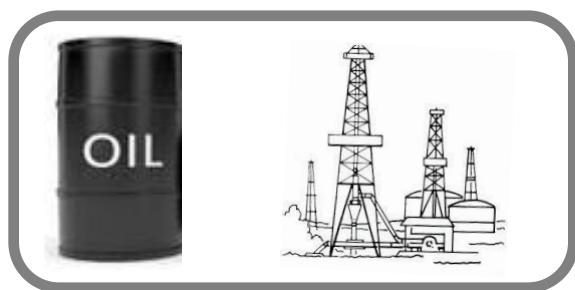
**prestazione energetica di un edificio:** quantità annua di energia primaria effettivamente consumata o che si prevede possa essere necessaria per soddisfare, con un uso standard dell'immobile, i vari bisogni energetici dell'edificio: la climatizzazione invernale e estiva, la preparazione dell'acqua calda per usi igienici sanitari, la ventilazione e, per il settore terziario, l'illuminazione, gli impianti ascensori e scale mobili.



**IL FABBISOGNO ENERGETICO DI UN EDIFICIO SI MISURA IN UNITA' DI ENERGIA PRIMARIA PER UNITA' DI SUPERFICIE PER UNITA' DI TEMPO (KWh/m²/anno)**

IL FABBISOGNO ENERGETICO DI UN EDIFICIO SI MISURA IN:  
**UNITA' DI ENERGIA PRIMARIA PER UNITA' DI SUPERFICIE PER UNITA' DI TEMPO**  
**KWh/m<sup>2</sup>/anno**

CHE COSA E' L'**ENERGIA PRIMARIA**:  
*energia, da fonti rinnovabili e non rinnovabili  
che non ha subito alcun processo di conversione o trasformazione*

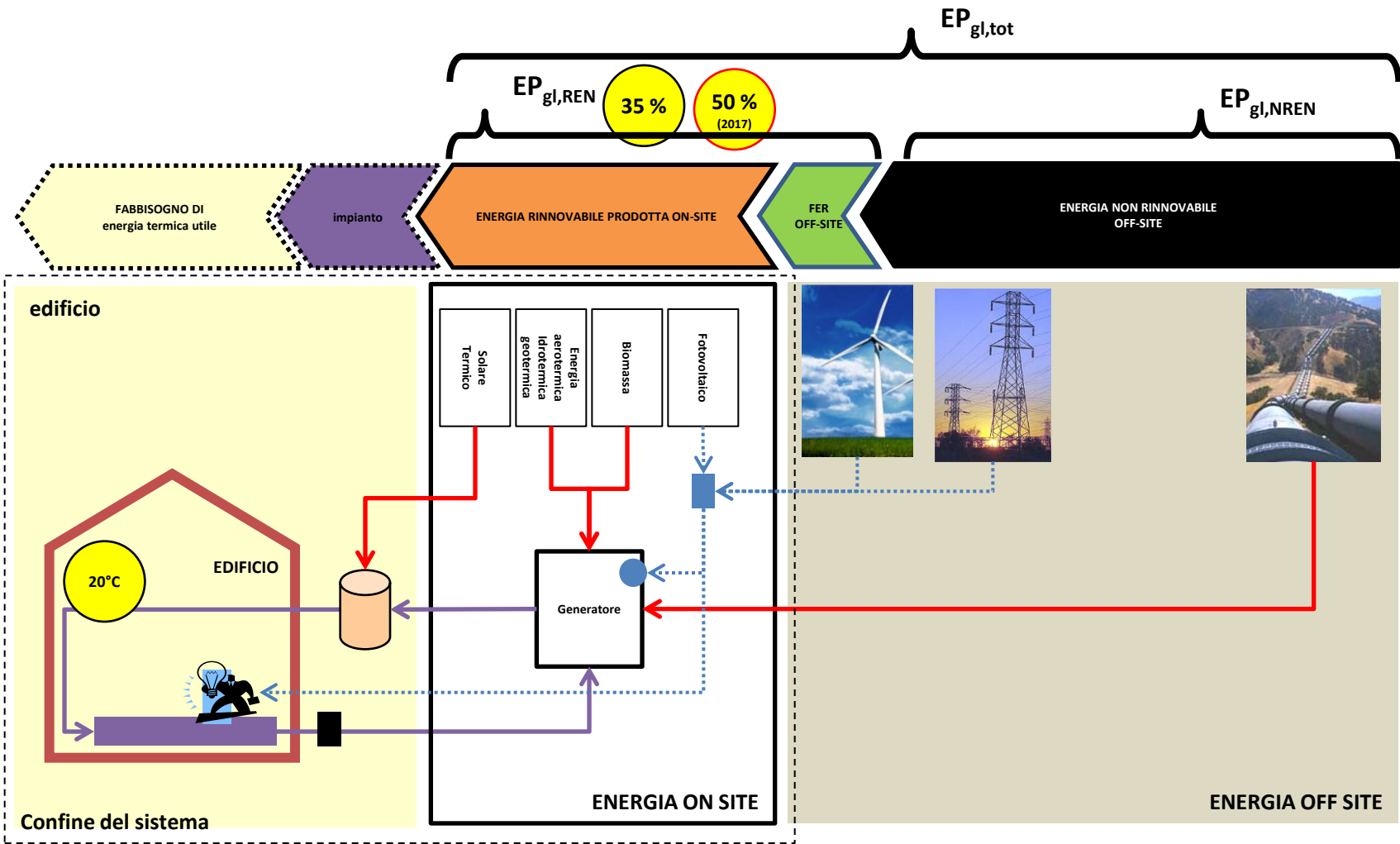


PER MISURARE IL FABBISOGNO ENERGETICO OCCORRE QUINDI TRASFORMARE L'ENERGIA FORNITA DA UN DATO VETTORE ENERGETICO  
IN ENERGIA PRIMARIA

*Il calcolo viene effettuato applicando un appropriato fattore di conversione*

**fattore di conversione in energia primaria**: rapporto adimensionale che indica la quantità di energia primaria impiegata per produrre un'unità di energia fornita, per un dato vettore energetico; tiene conto dell'energia necessaria per l'estrazione, il processamento, lo stoccaggio, il trasporto e, nel caso dell'energia elettrica, del rendimento medio del sistema di generazione e delle perdite medie di trasmissione del sistema elettrico nazionale e nel caso del teleriscaldamento, delle perdite medie di distribuzione della rete.

**Prestazione Energetica: Energia PRIMARIA REN e NREN**





**Il settore delle costruzioni (come sta cambiando)**

**Qualità della costruzione  
e verifica in sito**



**Posa in opera**

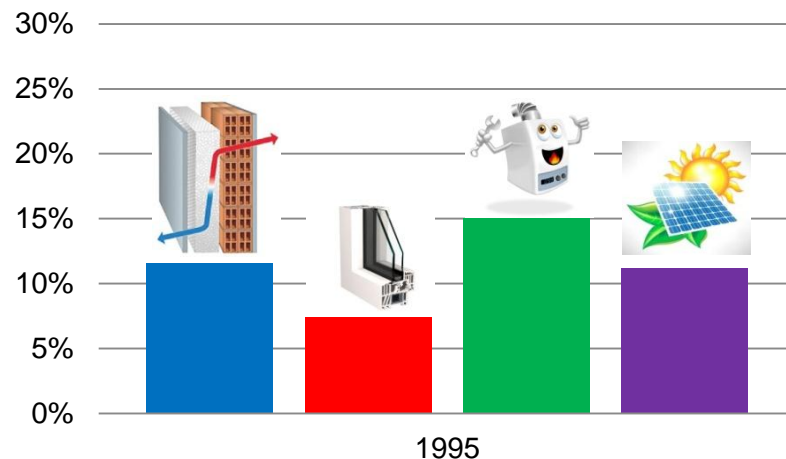
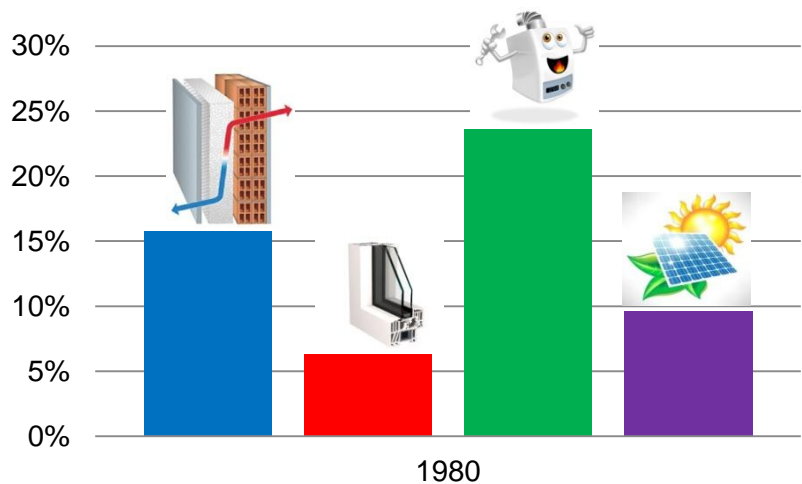
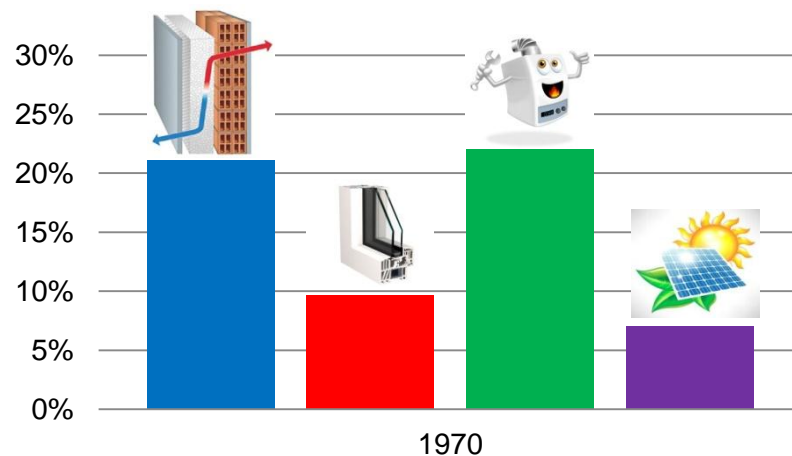
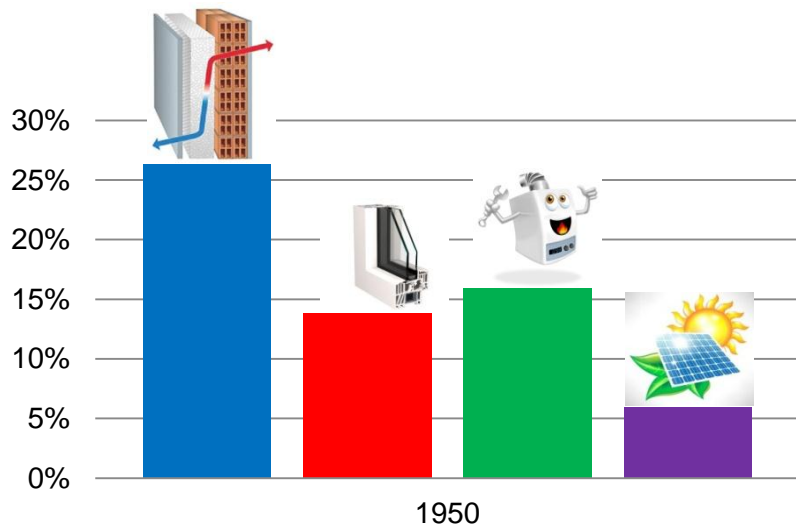


**Ponti termici e isolamenti**



**Più soggetti coinvolti**

**Il settore delle costruzioni (come sta cambiando)**



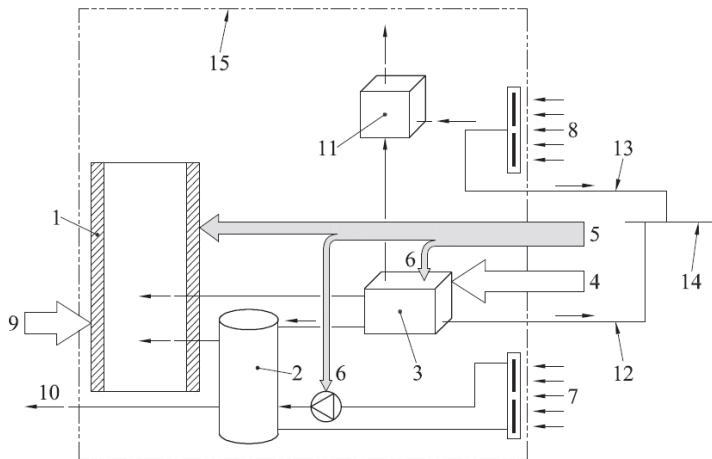
**Il settore delle costruzioni (come sta cambiando)**

Il fabbisogno di energia primaria ai fini della determinazione dell'indice EP è dato dal "bilancio" tra la quantità di energia consegnata ( $Q_{del}$ ) ed esportata ( $Q_{exp}$ ) attraverso il contorno del sistema edificio.

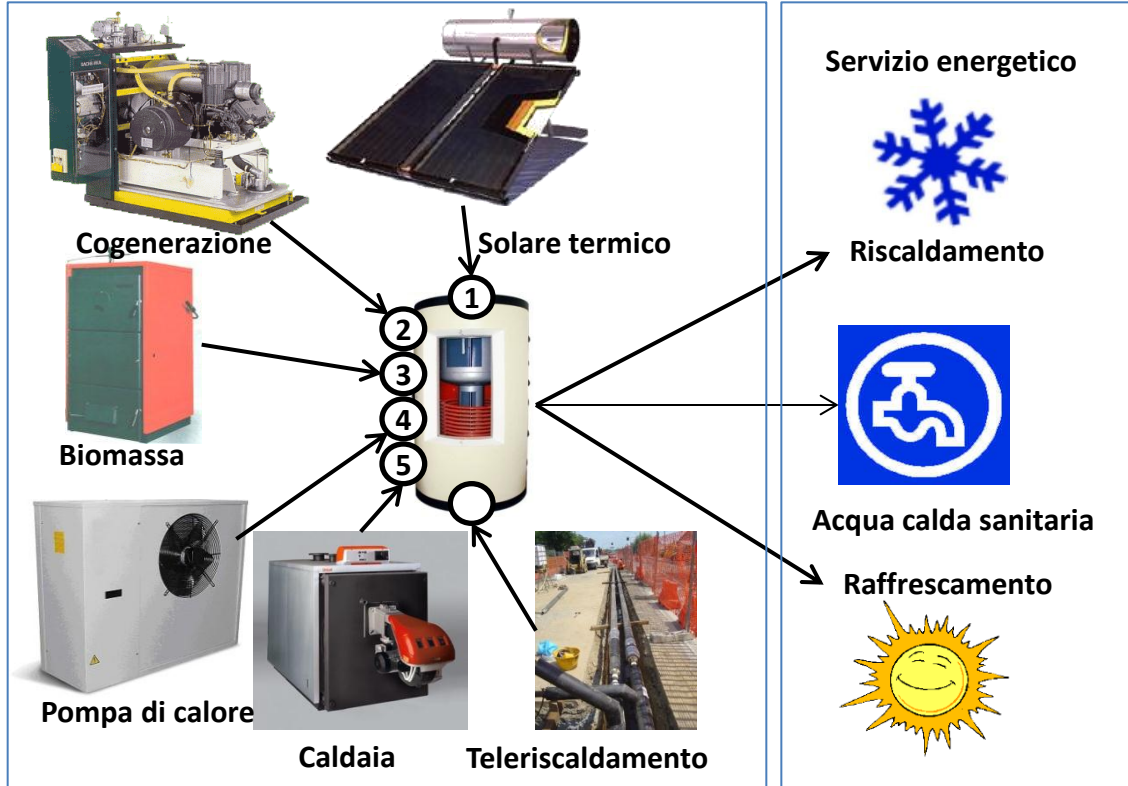
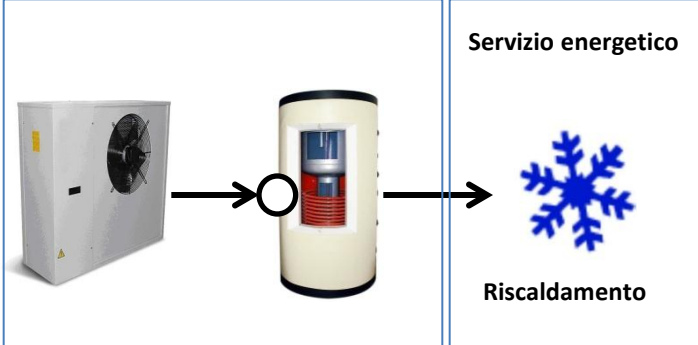
Confini del sistema edificio

Legenda

- 1 Utilizzazione (fabbisogno di energia termica)
- 2 Accumulo
- 3 Generatore
- 4 Vettore energetico primario
- 5 Energia elettrica
- 6 Energia per ausiliari
- 7 Collettori solari termici
- 8 Pannelli fotovoltaici
- 9 Energia termica utile fornita da rete
- 10 Energia termica utile esportata
- 11 Sistema di dissipazione del calore
- 12 Energia elettrica esportata da cogenerazione
- 13 Energia elettrica esportata da fotovoltaico
- 14 Rete elettrica pubblica
- 15 Confine del sistema



**Impianti polivalenti  
priorità degli  
interventi**



**L'attestato di prestazione energetica : REAL ESTATE**



Nuova realizzazione di unità residenziali. Varie tipologie, piano terra con giardino privato. Riscaldamento a pavimento radiante, acqua calda, sanitaria e luce condominiale a costo zero con impianto fotovoltaico.

Prezzi a partire da Euro [redacted] garage e cantina.

*Tra le misure proposte dalla legge per agevolare le imprese, si prevede anche la riduzione dell'Ici*

**Edilizia, il rilancio passa dalle pmi**

*Privilegiare il piano per le opere pubbliche di piccole dimensioni*

*Certificato del ministro Pd. Vero il Pd si è mosso sul fronte della qualità delle costruzioni*

**L'architettura «rilancia»**

*Sommessa sulla trasparenza ma si parte senza le risorse*

Fai salire il valore della tua casa

**PEEP VISERBA** Assemblea per il caro-gas

## Duecento teleriscaldati fanno fuoco e fiamme

Una federazione che opera come "regolatore" ha convocato l'assemblea di Peep Viserba. Il presidente è stato eletto il signor... (text continues)

**«Quel sistema ci è costato milioni»**

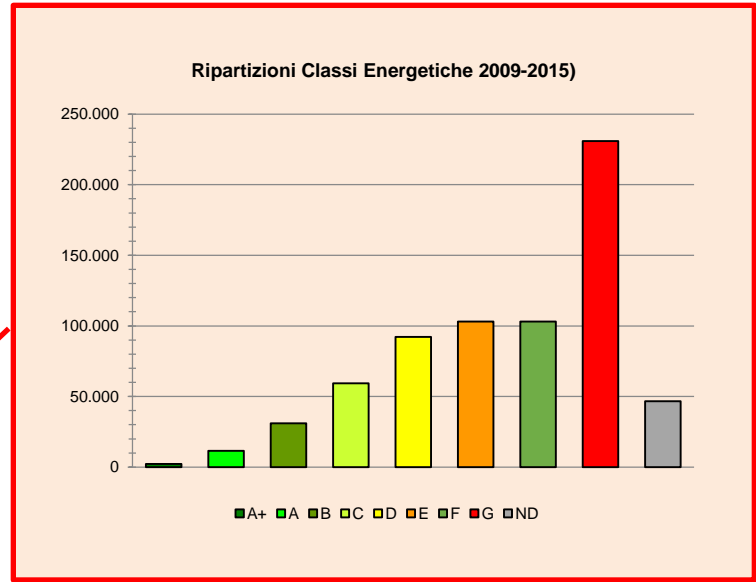
Un'indagine di un giudice... (text continues)

**Certificazione Energetica Emilia-Romagna  
Gli effetti dell' ENERGY LABELLING**

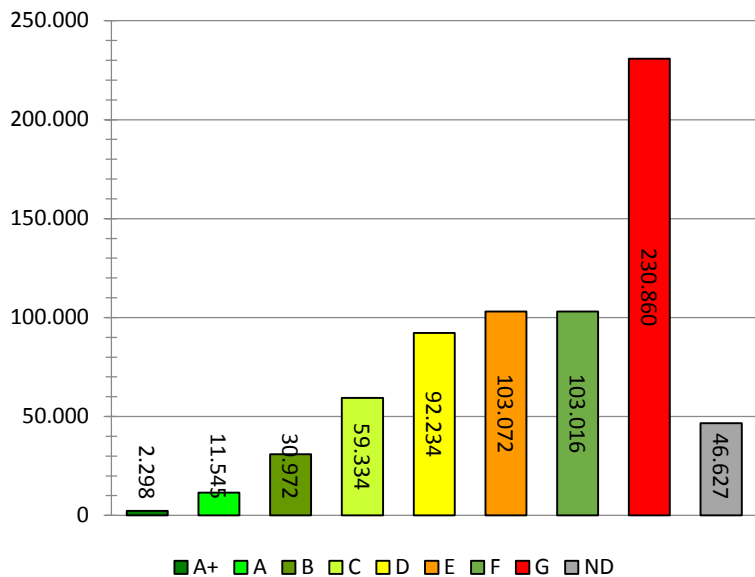
**Regione Emilia-Romagna RESIDENZE**

di cui si conosce la  
prestazione energetica  
(APE)  
25,70%

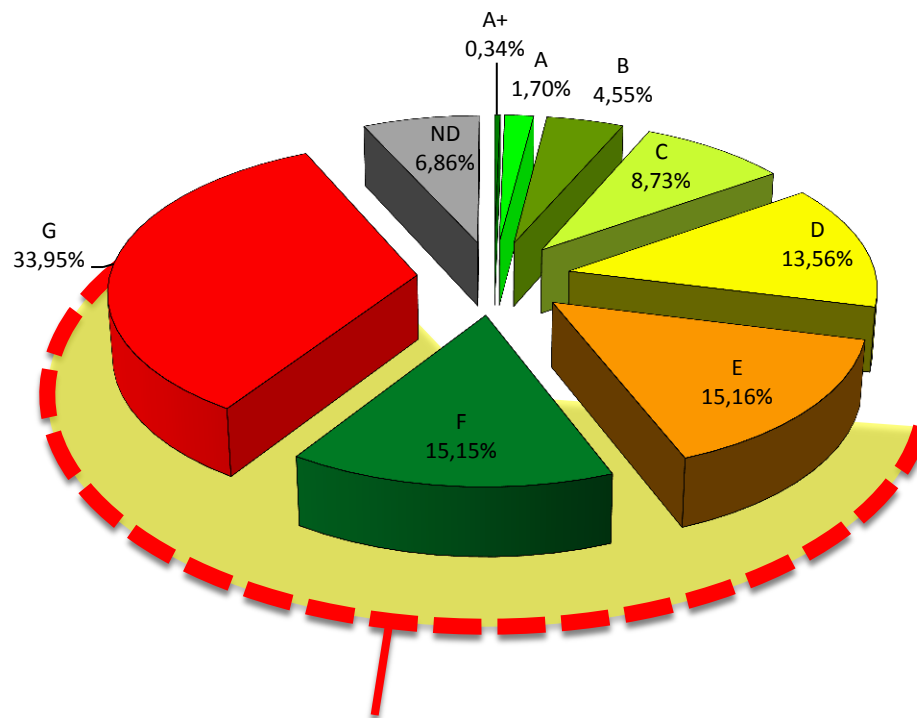
di cui NON si conosce la  
prestazione energetica (NO  
APE)  
74,30%



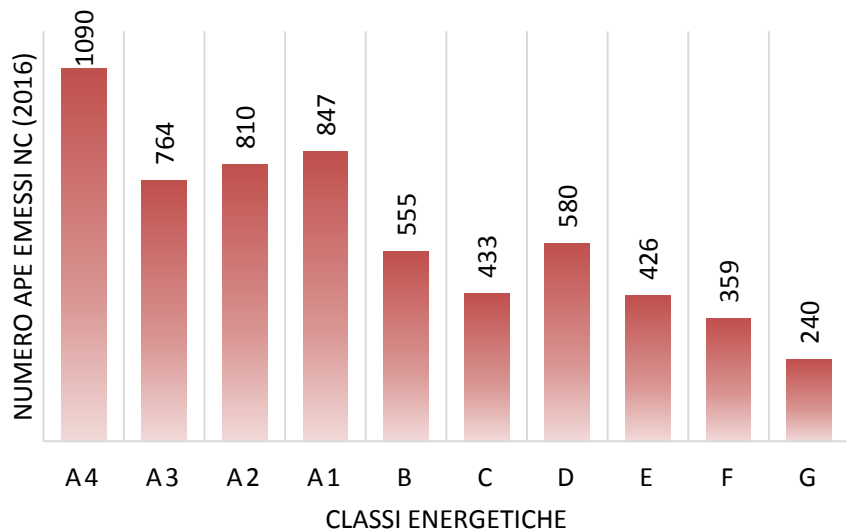
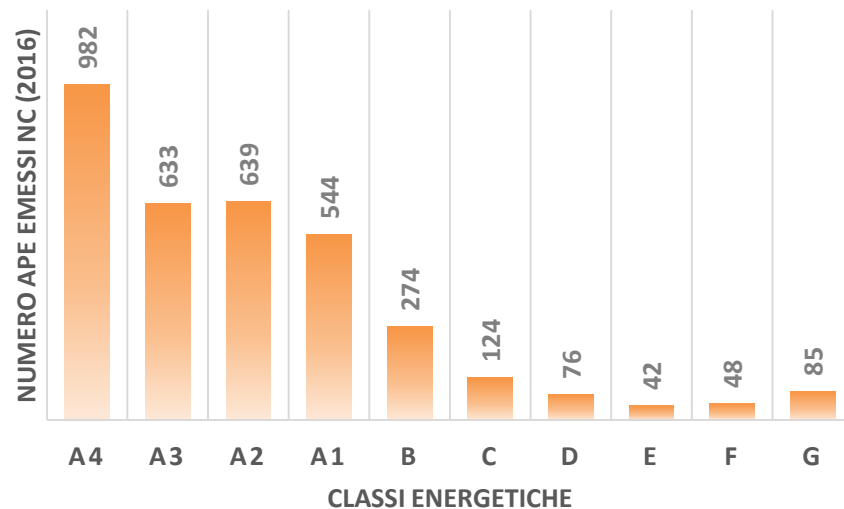
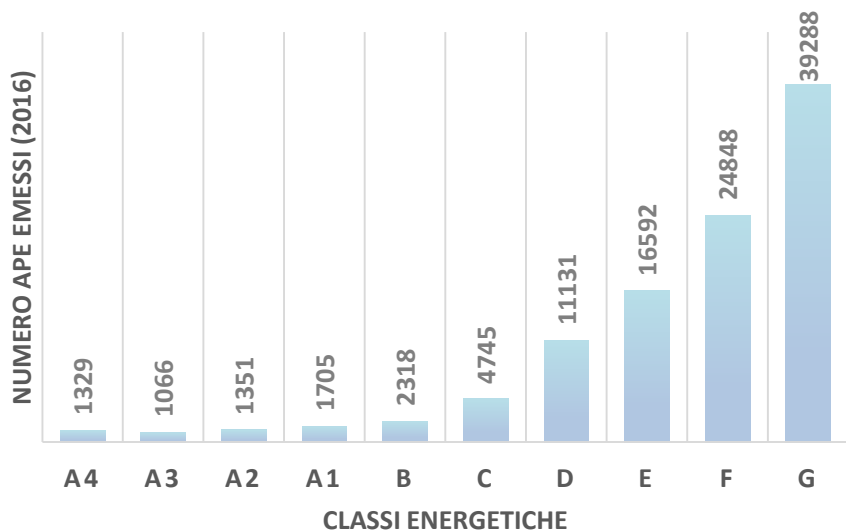
**Distribuzione Classi Energetiche - Totale attestati emessi**



**Distribuzione Classi Energetiche - Totale attestati emessi**

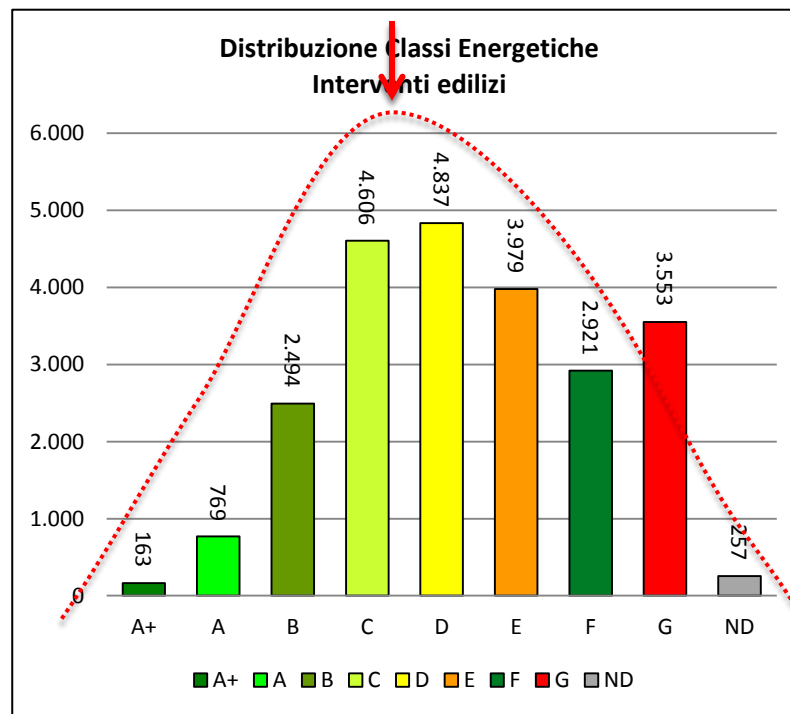
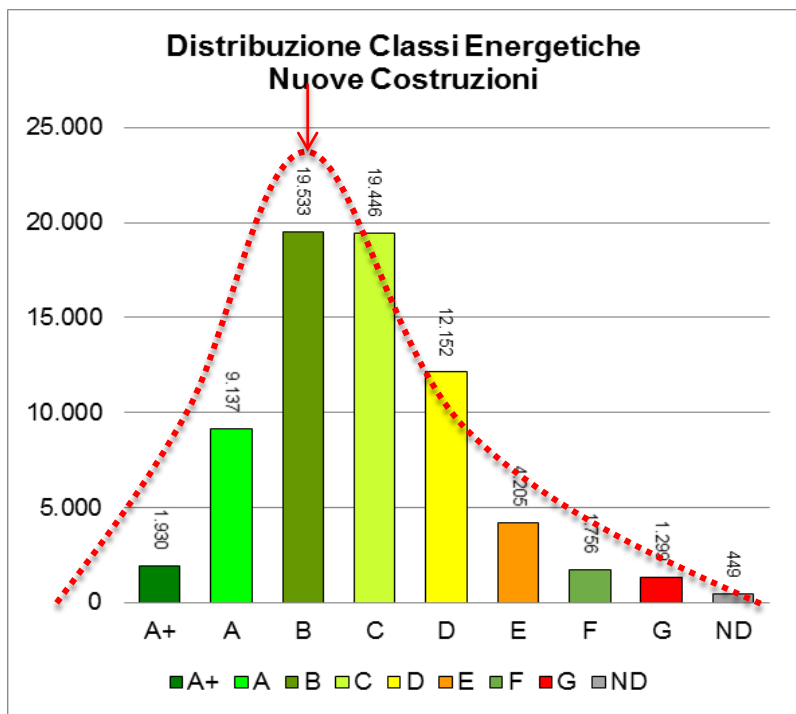


**Possibile riqualificazione energetica**



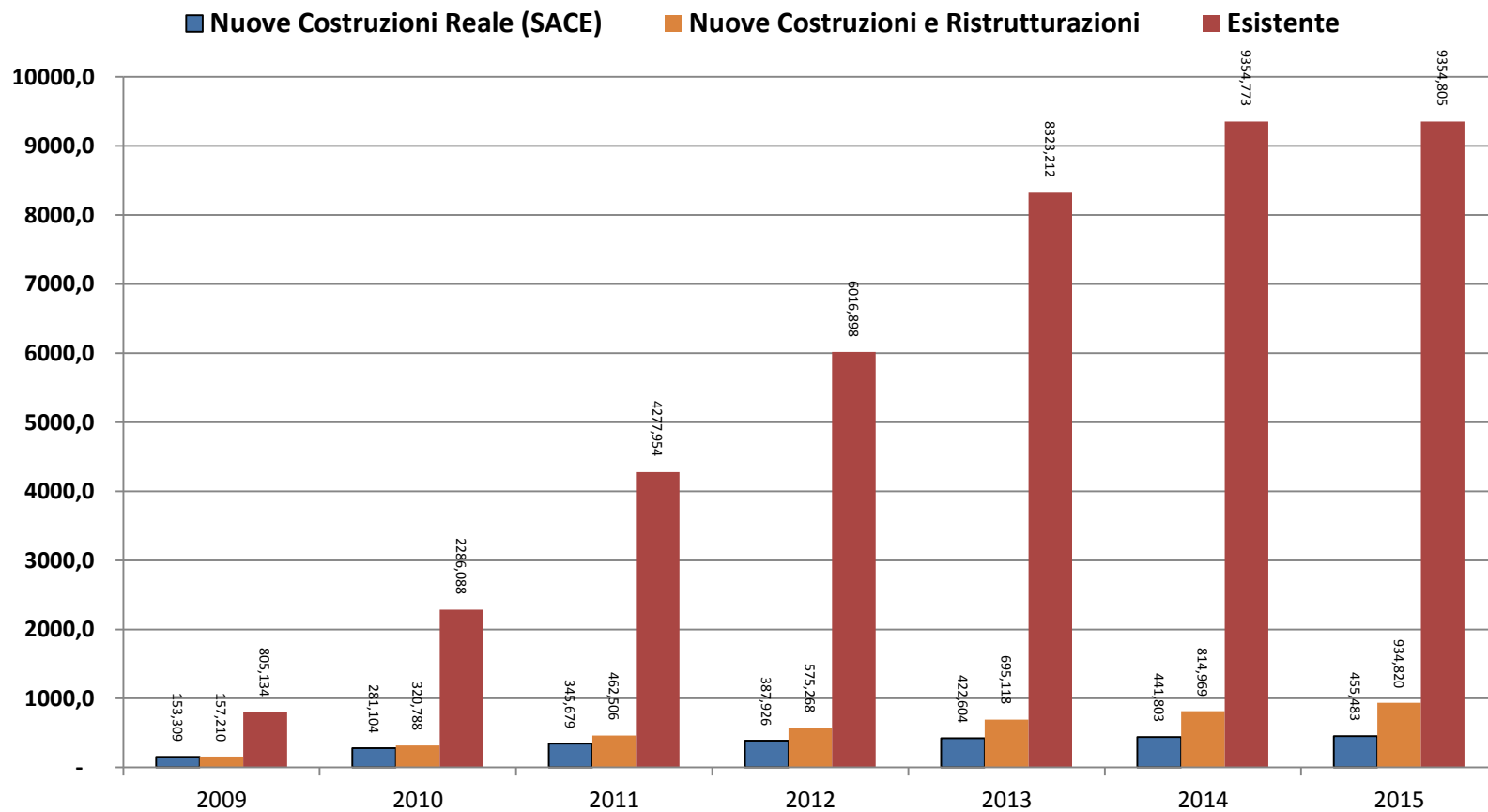
Distribuzione delle Classi Energetiche nel 2016 - Edifici di Nuova Costruzione

Distribuzione delle Classi Energetiche nel 2016 - Edifici di Nuova Costruzione-  
Ristrutturazione Importante e Riquilificazione Energetica



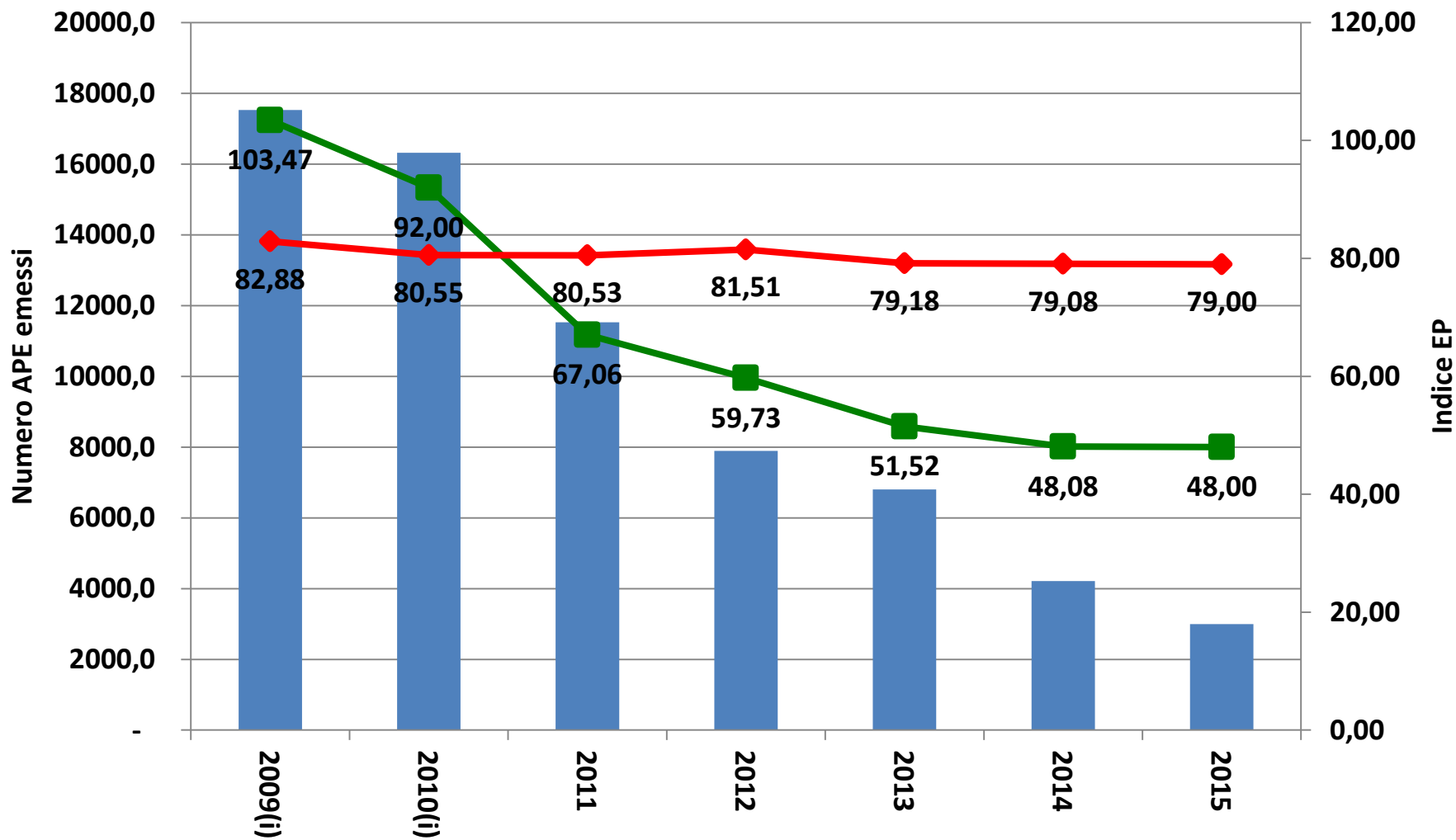


**Fabbisogno energia primaria (GWh/anno)**



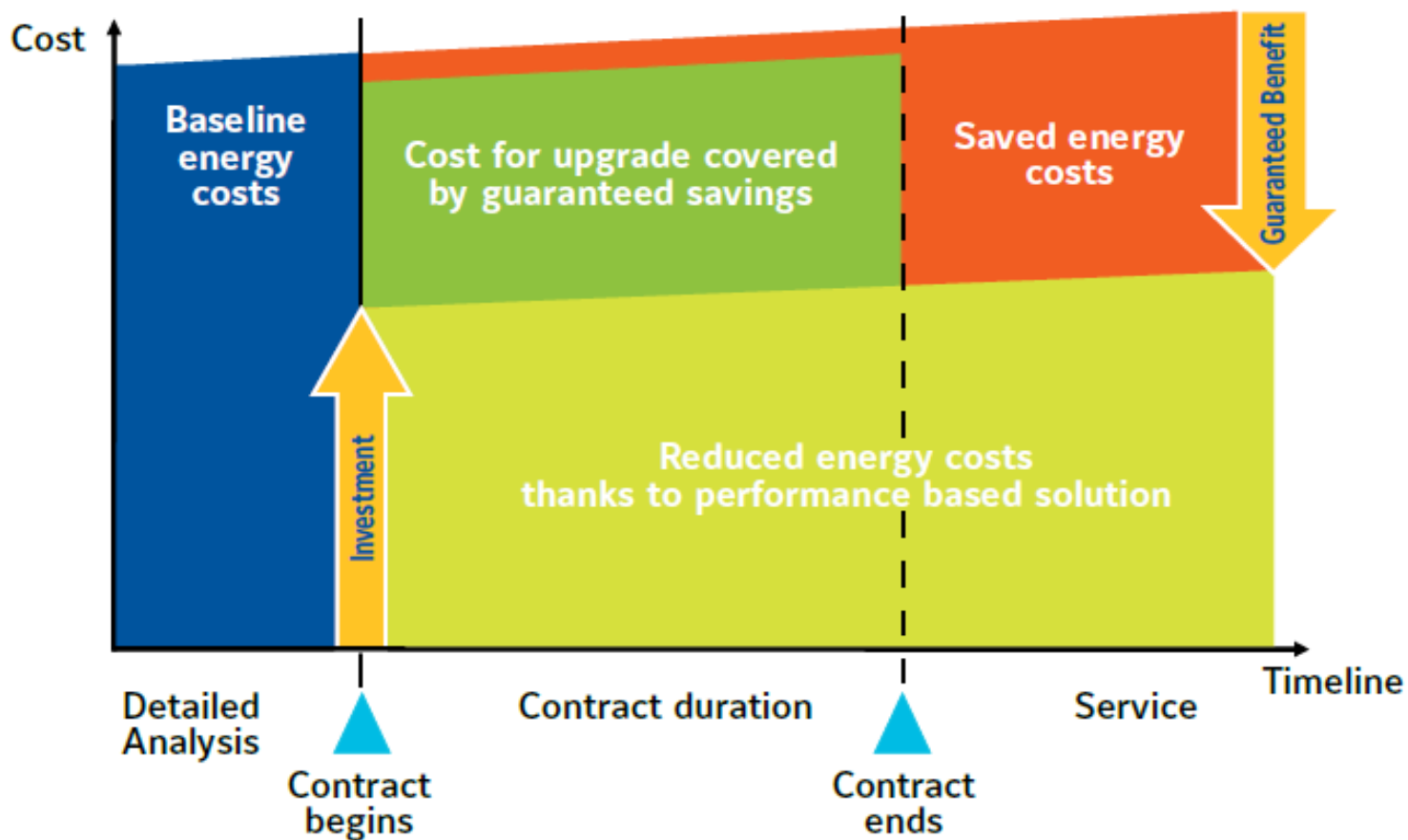
**Certificazione Energetica Emilia-Romagna  
Gli effetti dell' ENERGY LABELLING**

■ n.° APE   ■ indice EP   ◆ indice EP lim



**Energy Performance Contract - EPC**  
**Contratti di prestazione energetica & Contratto servizio energia**

*Figure 1. Performance Contracting at a Glance*



*Grazie  
dell'attenzione*



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