Costruire a basso consumo

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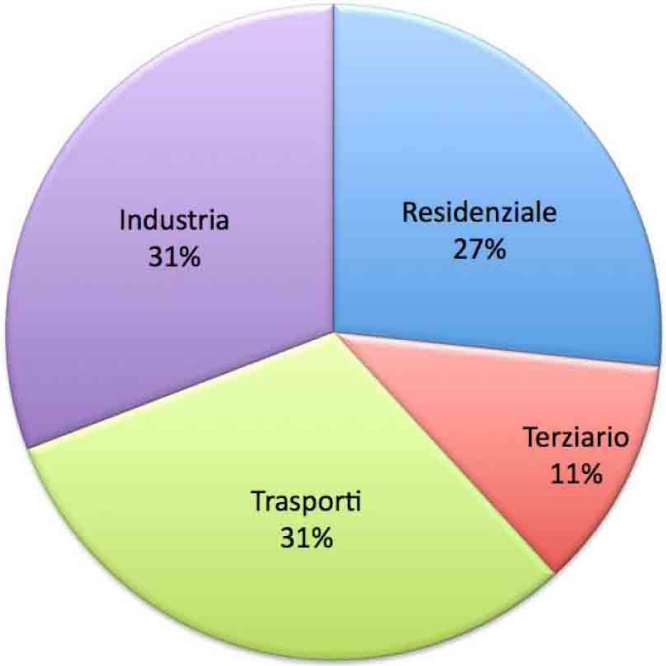
Congresso internazionale
Efficienza energetica negli edifici – Stratégies européennes et interventions locales
Saint Vincent, 22 ottobre 2009

The relation between emissions and climate change according to Climate Change 2007, IPCC

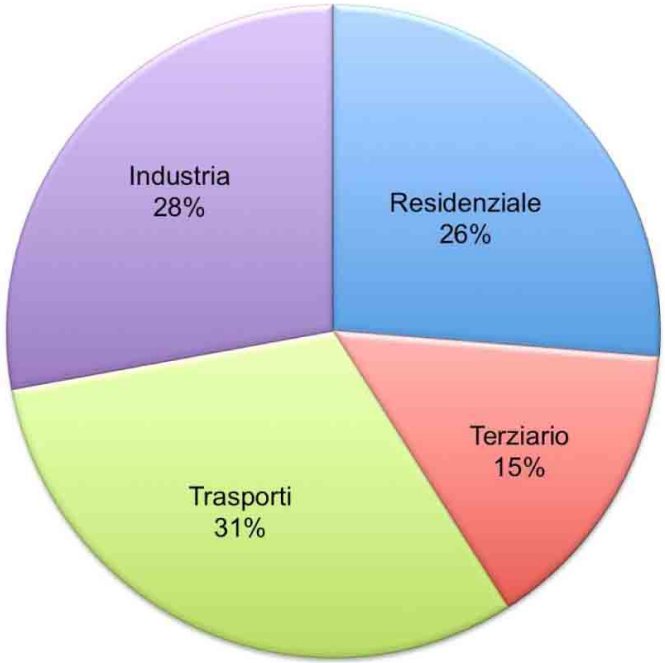
Temperature increase (°C)	All GHGs (ppm CO_2 eq.)	CO_2 (ppm CO_2)	CO_2 emissions 2050 (% of 2000 emissions) (%)
2.0-2.4	445-490	350-400	–85 to –50
2.4-2.8	490-535	400-440	–60 to –30
2.8-3.2	535-590	440-485	–30 to +5
3.2-4.0	590-710	485-570	+10 to +60

Source: IPCC, 2007.

Ripartizione dei consumi energetici finali



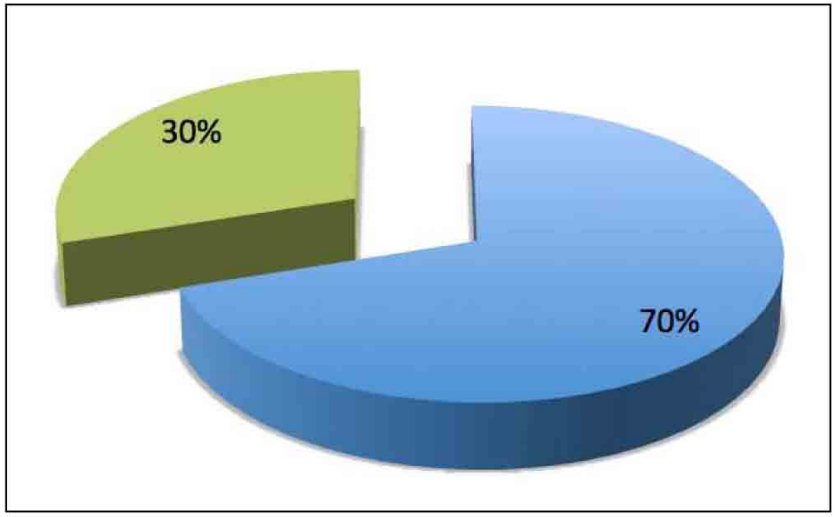
Europa



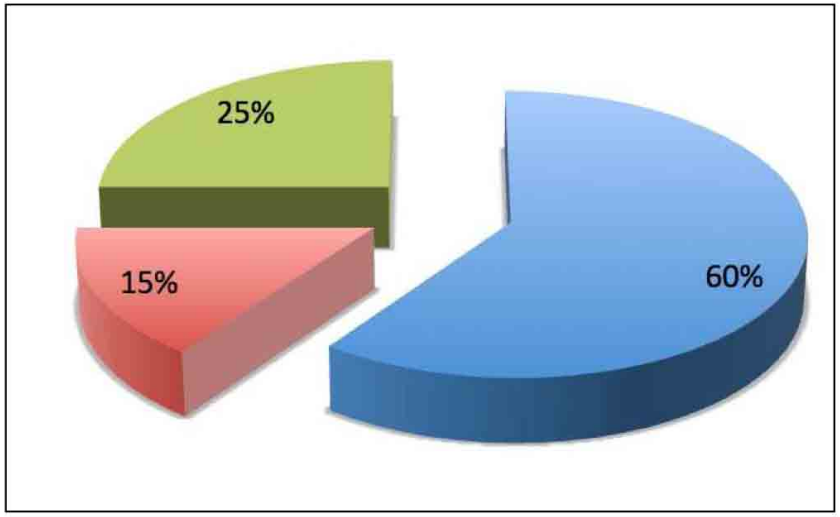
Italia

Il parco edilizio nel 2050

Gran Bretagna



Francia



Edifici costruiti prima del 2010 Incertezza Edifici costruiti fra il 2010 e il 2050

Proposal for a directive of the European Parliament and of the Council on the energy performance of buildings (recast)

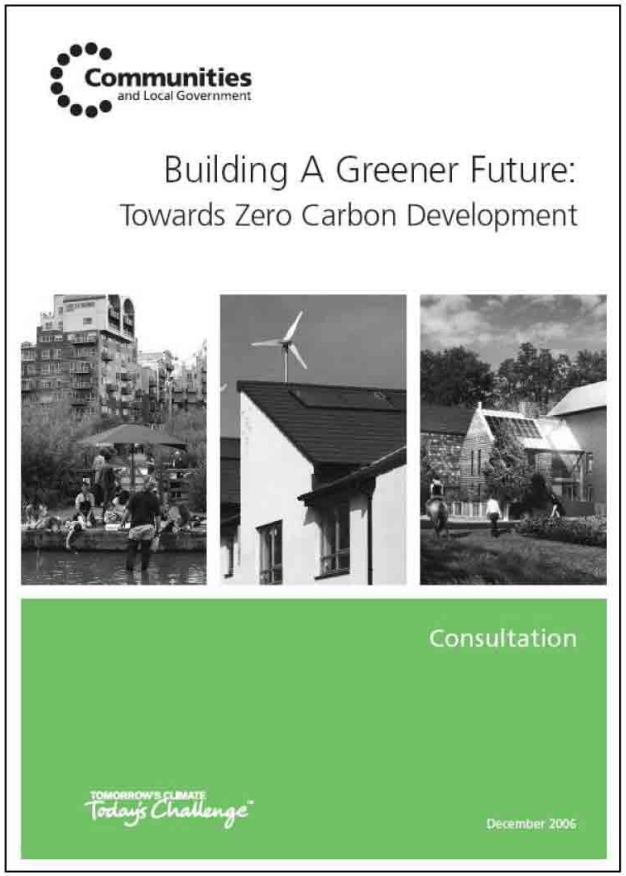
Art. 9

"Net zero energy building" means a building where, as a result of the very high level of energy efficiency of the building, the overall annual primary energy consumption is equal to or less than the energy production from renewable energy sources on site.

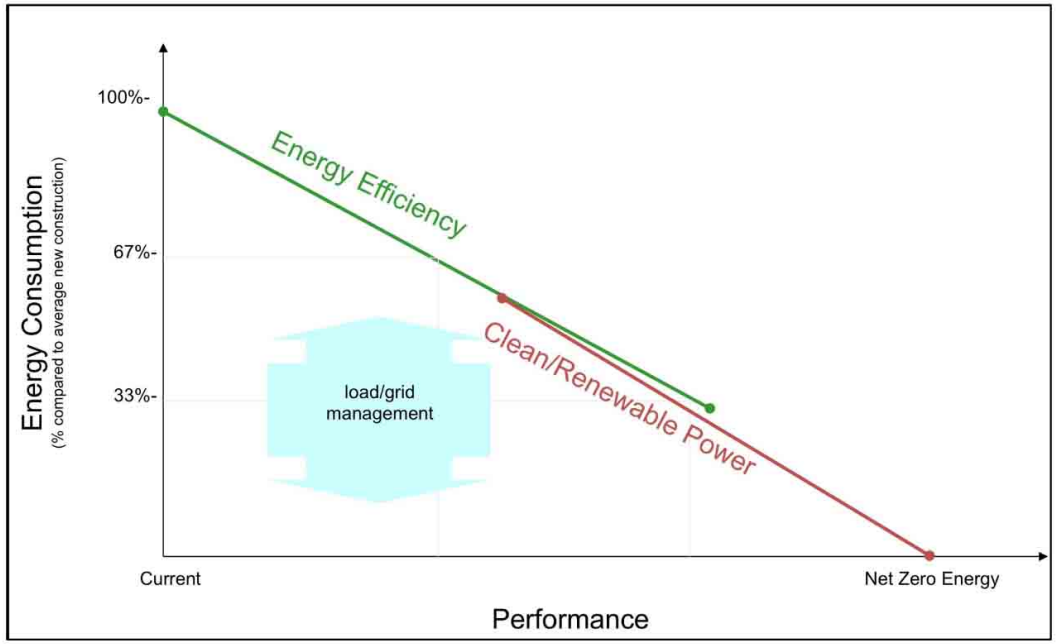
Member States shall draw up national plans for increasing the number of net zero energy buildings.

Members States shall ensure that all new buildings are at least net zero energy buildings by 31 December 2018 at the latest.

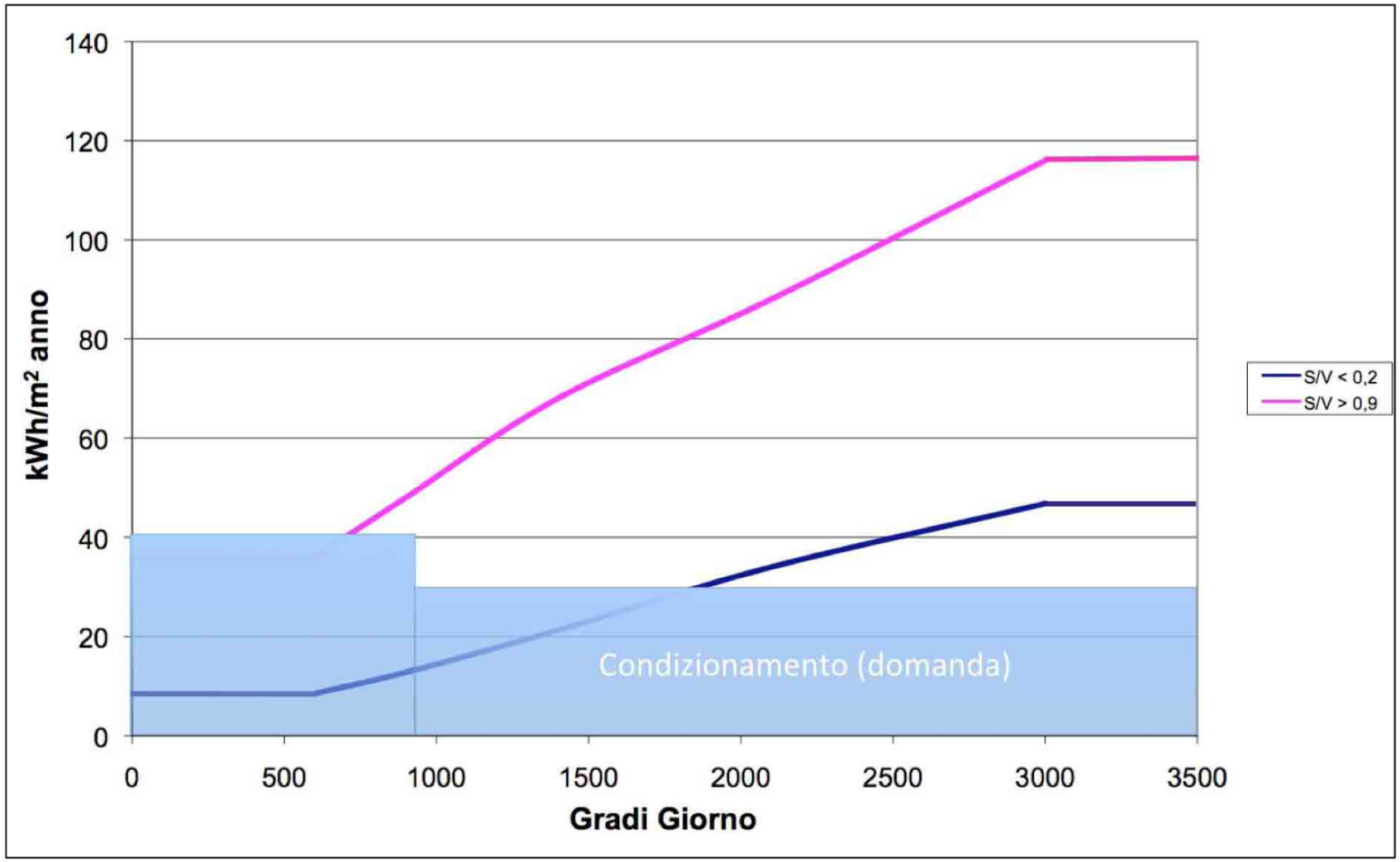
For buildings occupied by public authorities, Member States shall set targets to be reached significantly in advance of the periods set out in the first and second subparagraphs, taking into account the leading role which public authorities should play in the field of energy performance of buildings.



Use less energy (Be Lean)
Supply energy efficiently (Be Clean)
Use renewable energy (Be Green)

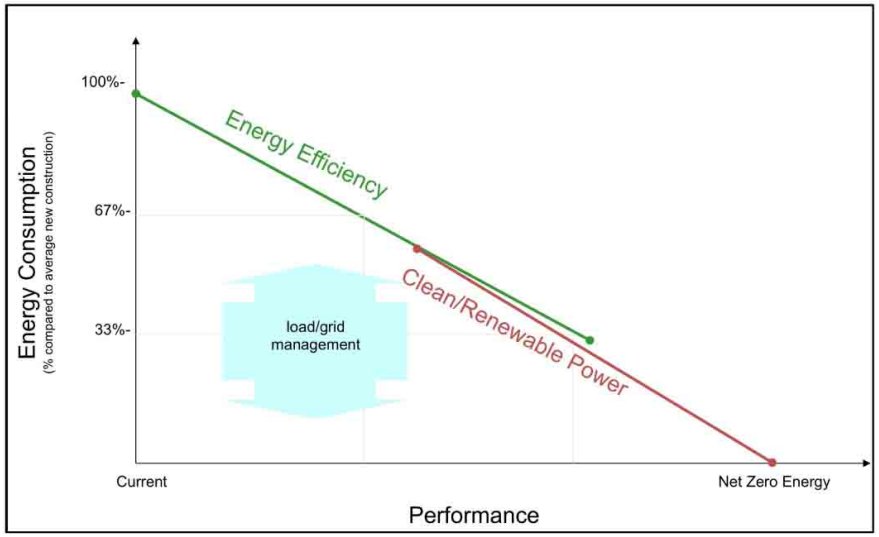


Date	2010	2013	2016
Energy/carbon improvement as compared to Part L (Building Regulations 2006)	25%	44%	zero carbon
Equivalent energy/carbon standard in the Code	**Code level 3**	**Code level 4**	**Code level 6**



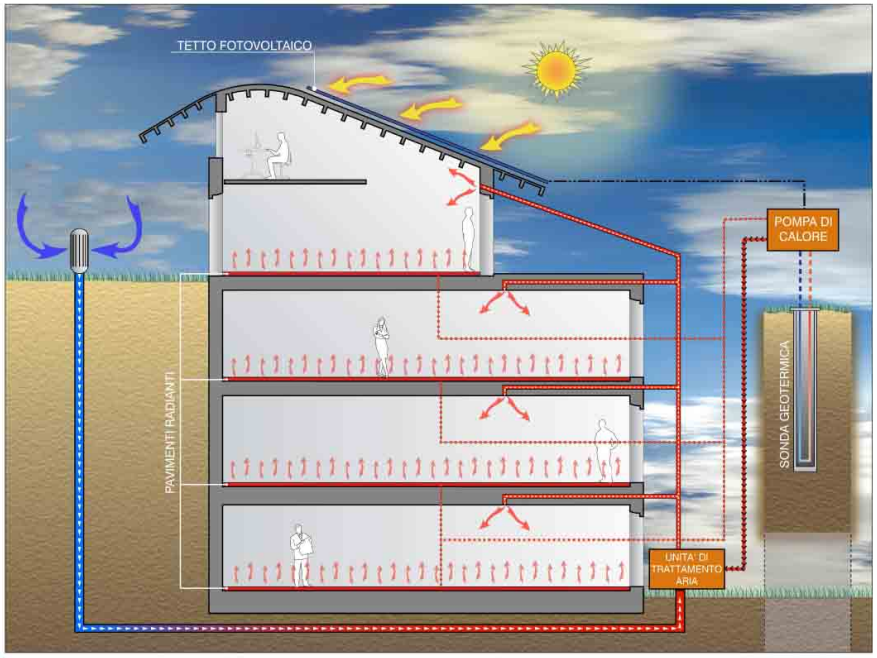
Metodo di calcolo	Mensile	Orario
Riscaldamento	Affidabile	Affidabile
Condizionamento	Inaffidabile	Affidabile
Flussi di calore fra zone	Molto difficile	Facile
Comfort estivo	Molto difficile	Facile

Leaf House: un edificio residenziale a emissioni zero
Angeli di Rosora (Jesi)



Riscaldamento e condizionamento

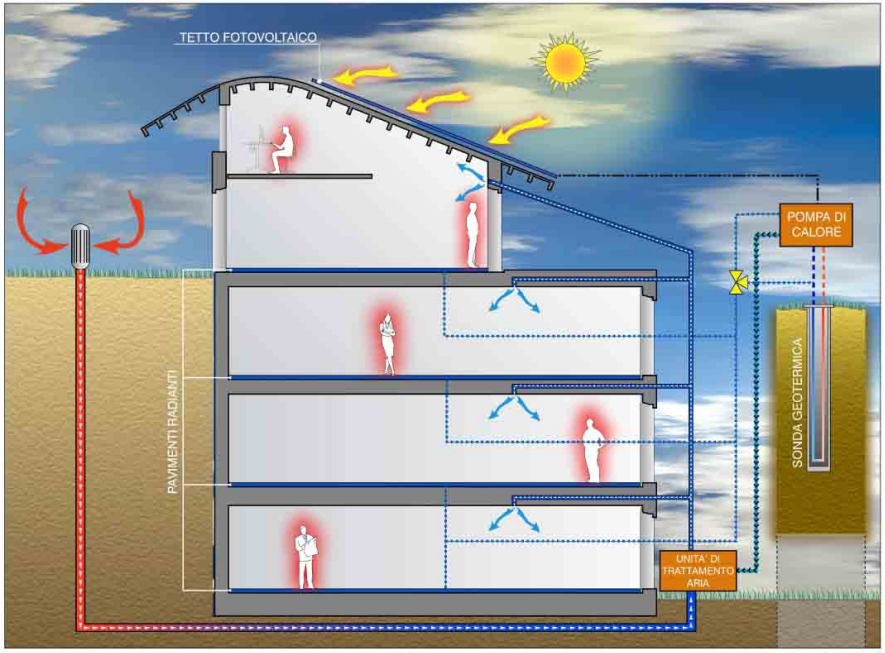
Inverno



Domanda di energia: 16 kWh/m^2 anno

Consumo di elettricità: 4 kWh/m^2 anno

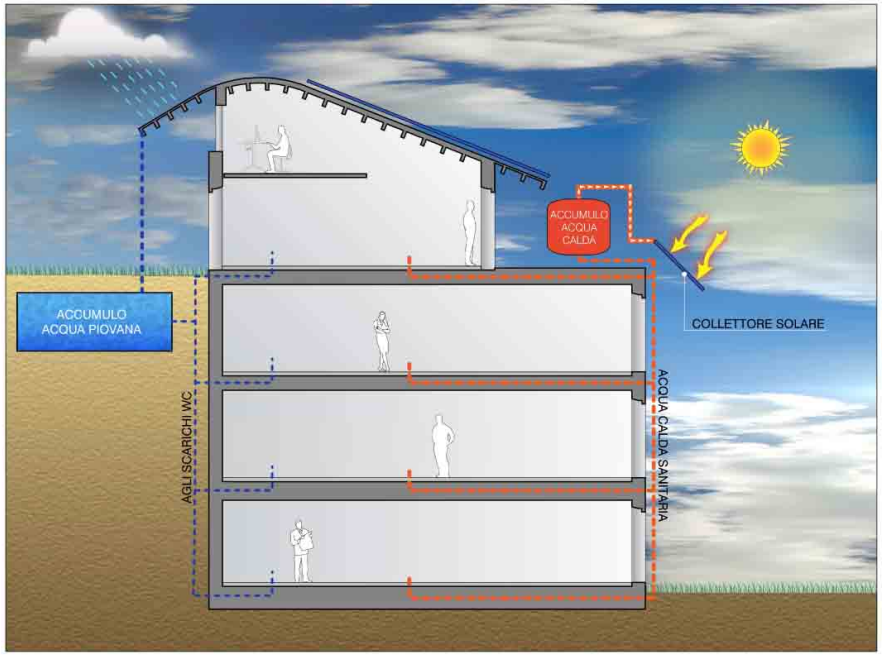
Estate

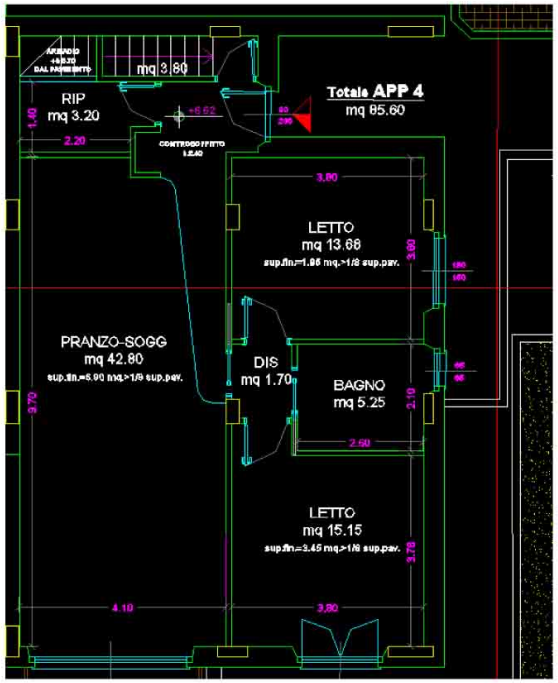


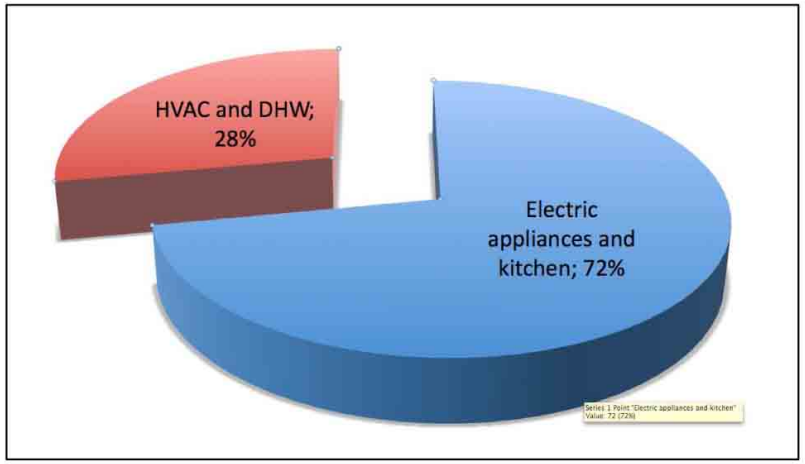
Domanda di energia: 16 kWh/m^2 anno

Consumo di elettricità: 3 kWh/m^2 anno

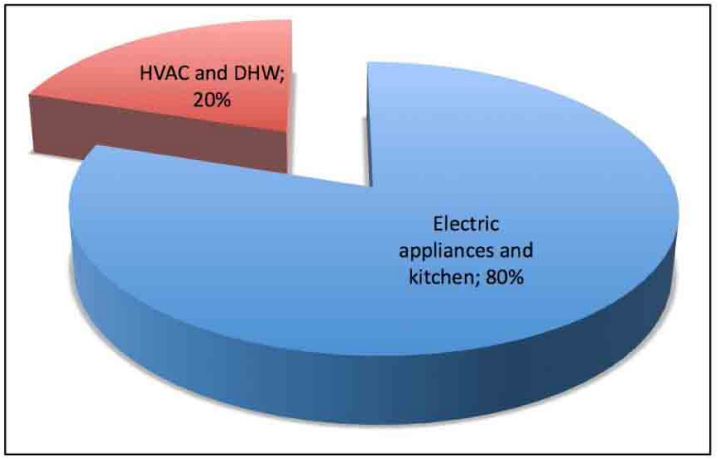
Valori previsti


ACCUMULO
ACQUA
CALDA
COLLETTORE SOLARE
ACCUMULO
ACQUA PIOVANA
AGLI SCARICHI WC
ACQUA CALDA SANITARIA

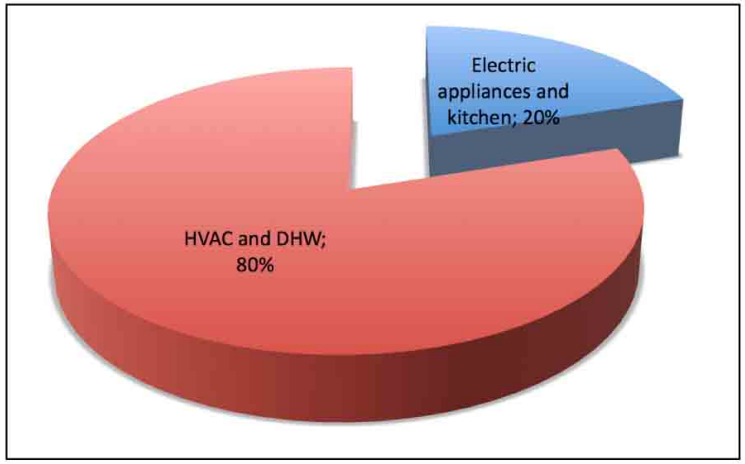

mq 3.80
RIP
mq 3.20
Totale APP 4
mq 85.60
LETTO
mq 13.68
PRANZO-SOGG
mq 42.80
DIS
mq 1.70
BAGNO
mq 5.25
LETTO
mq 15.15



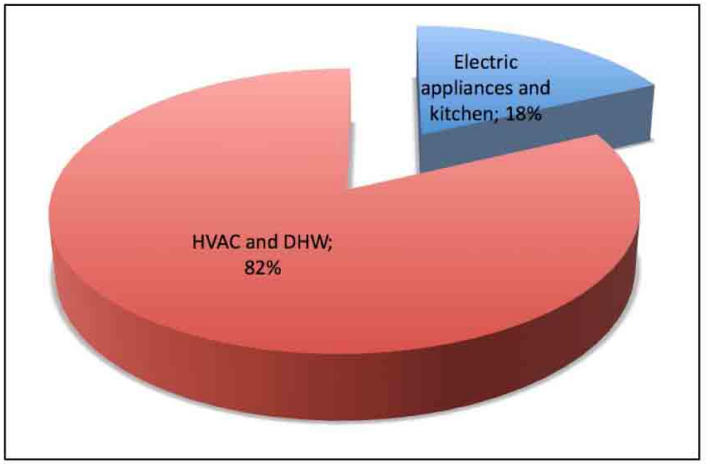
Abondance Le Soleil, Canada (measured)



Leaf House (predicted)



Italy



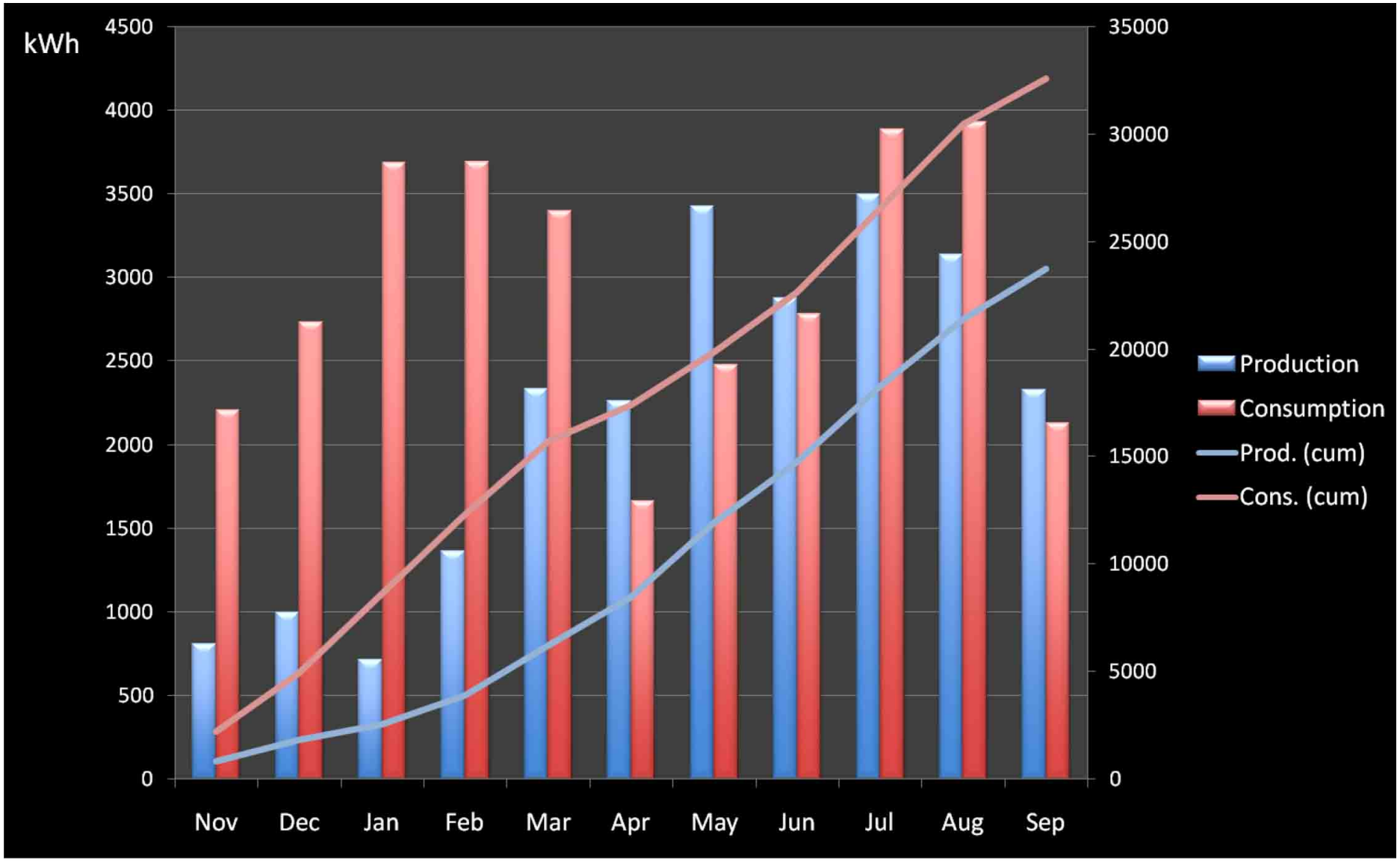
EU-15

Strategie per ridurre il consumo energetico

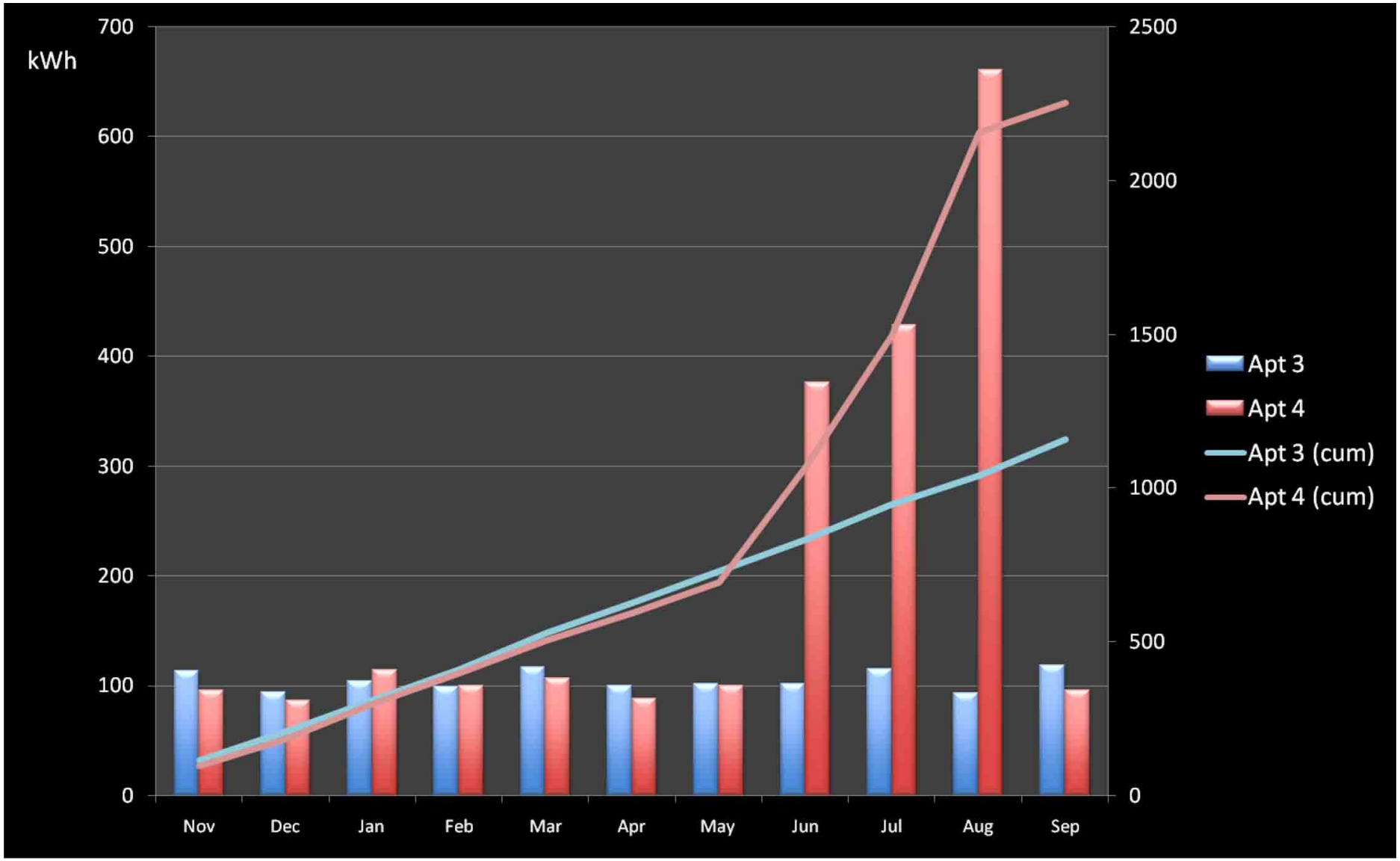
- Lavabiancheria e lavastoviglie alimentate da acqua calda solare
- Elettrodomestici A+
- Lampade fluorescenti compatte
- Ventilazione meccanica controllata da sensori di CO_2
- Apparecchi per la eliminazione dei consumi dovuti allo standby
- Il “cruscotto”




Bilancio Energetico



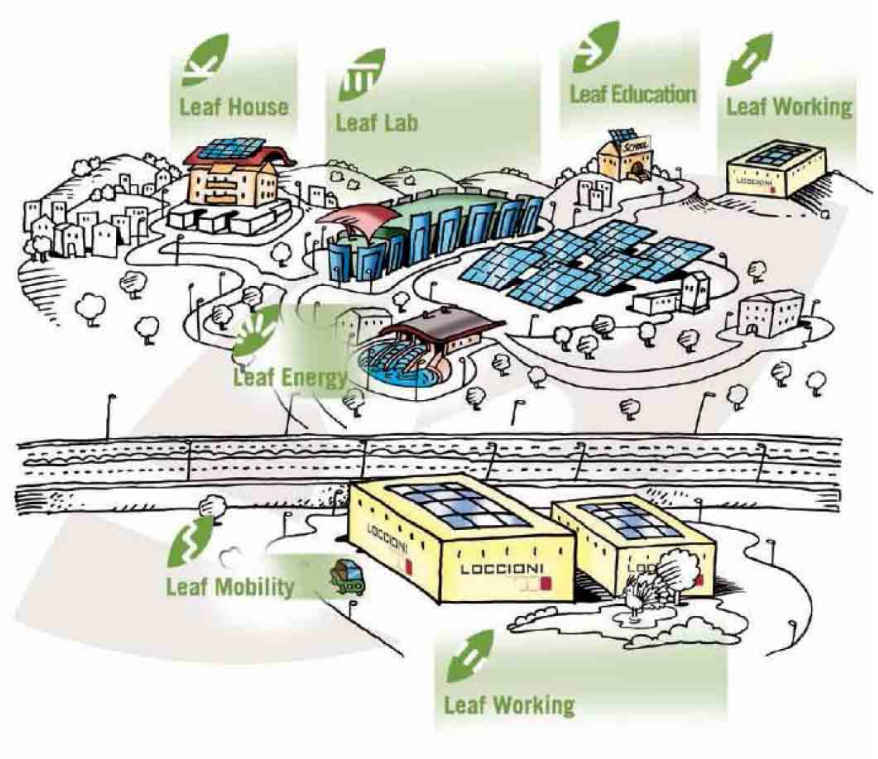
Consumo di energia elettrica nei due appartamenti permanentemente occupati



Problemi emersi

- ❑La temperatura degli appartamenti è stata tenuta a 21-22 °C invece dei 20 °C previsti
- ❑I carichi interni sono bassi
- ❑Le serrande e le tende vengono di solito tenute chiuse (guadagni solari piccoli o nulli)
- ❑Le finestre sono tenute chiuse nelle mezze stagioni, anche se le condizioni di temperatura esterna sono tali da offrire comfort con ventilazione naturale.
- ❑Le pompe consumano troppa energia elettrica: devono essere tarate meglio
- ❑Il COP della pompa di calore è risultato più basso di quanto indicato nelle specifiche tecniche della macchina

Leaf Community



Regional Environmental Center for Central and Eastern Europe

Ristrutturazione del Conference Center Building

Szentendre, Ungheria

100% fossile

100% solare

Prospetto est

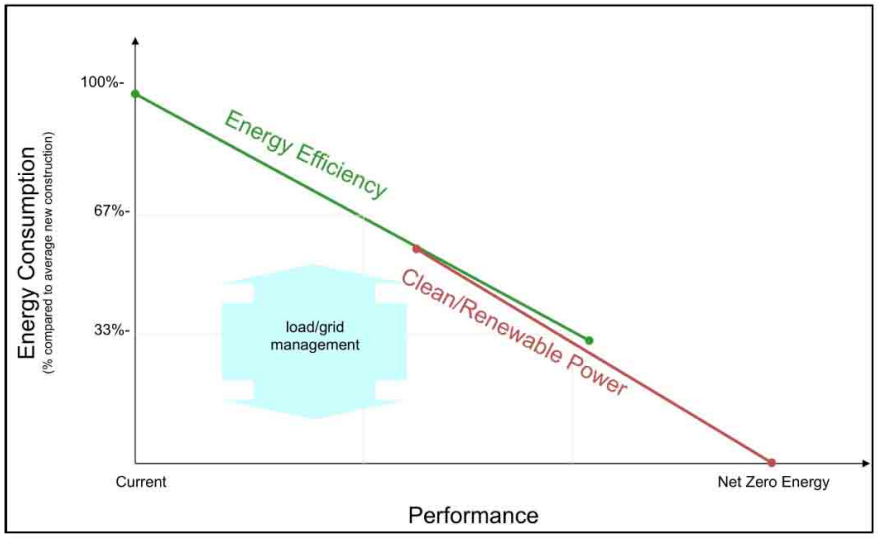
Prospetto ovest

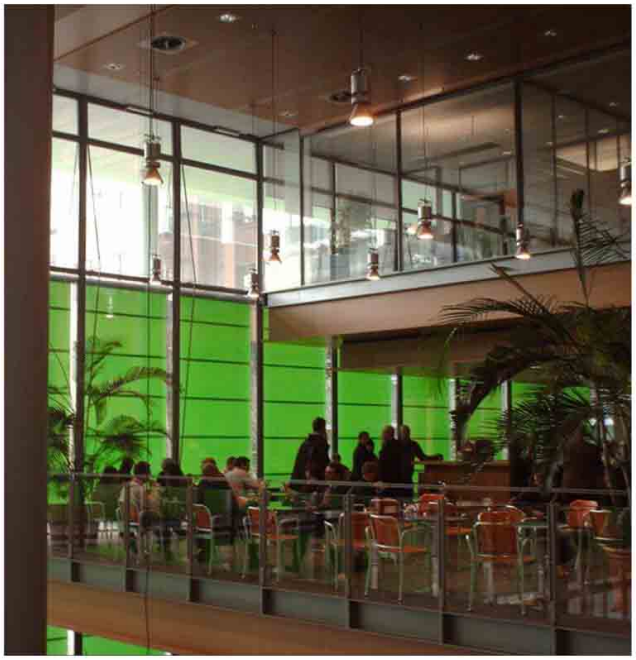
Consumo medio annuo di energia : 21 MWh elettricità; 200 MWh gas. Tutto fossile
Emissioni di CO_2: 59 ton/anno

Consumo medio previsto di energia: 28 MWh/a. Zero fossile
Emissioni di CO_2 previste: 0 ton/anno

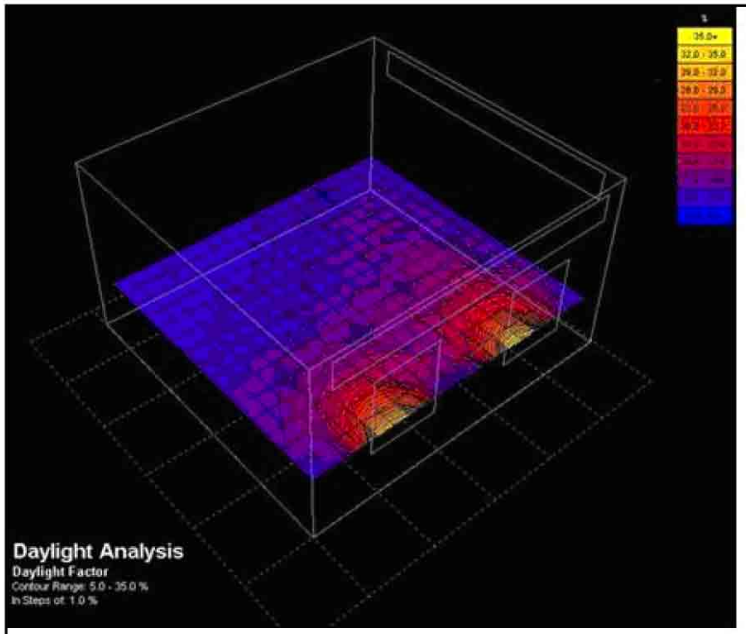
Principali caratteristiche energetiche dell'edificio ristrutturato

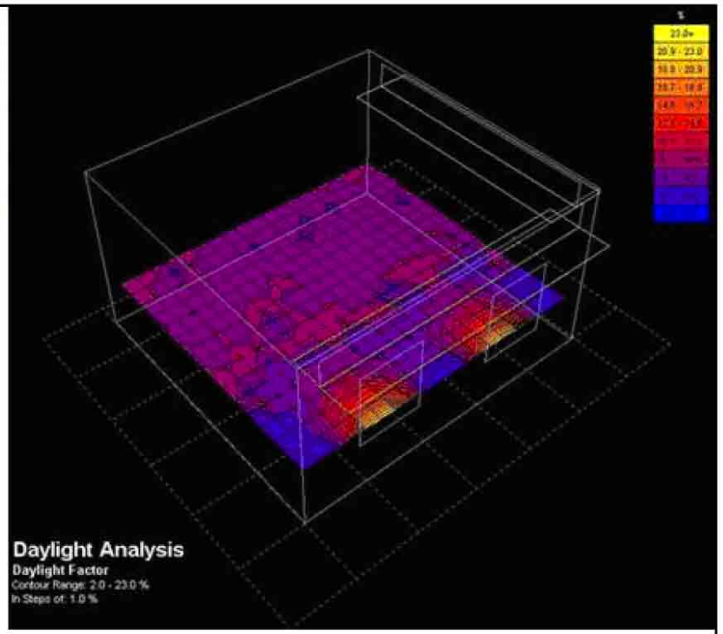
- ❑ Isolamento dell'involucro ottimizzato
- ❑ Valorizzazione dell'illuminazione naturale e controllo dell'abbagliamento
- ❑ Gestione avanzata della illuminazione artificiale
- ❑ Soffitti radianti
- ❑ Flusso di aria di rinnovo variabile in funzione del numero di persone
- ❑ Pompa di calore geotermica
- ❑ Pompe e ventole a velocità variabile
- ❑ Sistema di controllo e regolazione avanzato
- ❑ Sistema fotovoltaico
- ❑ Costo in linea con quello di una ristrutturazione di qualità





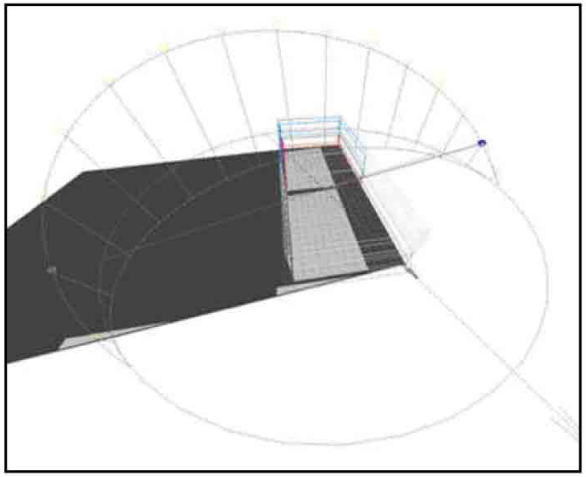
Illuminazione naturale con completo controllo dell’abbagliamento



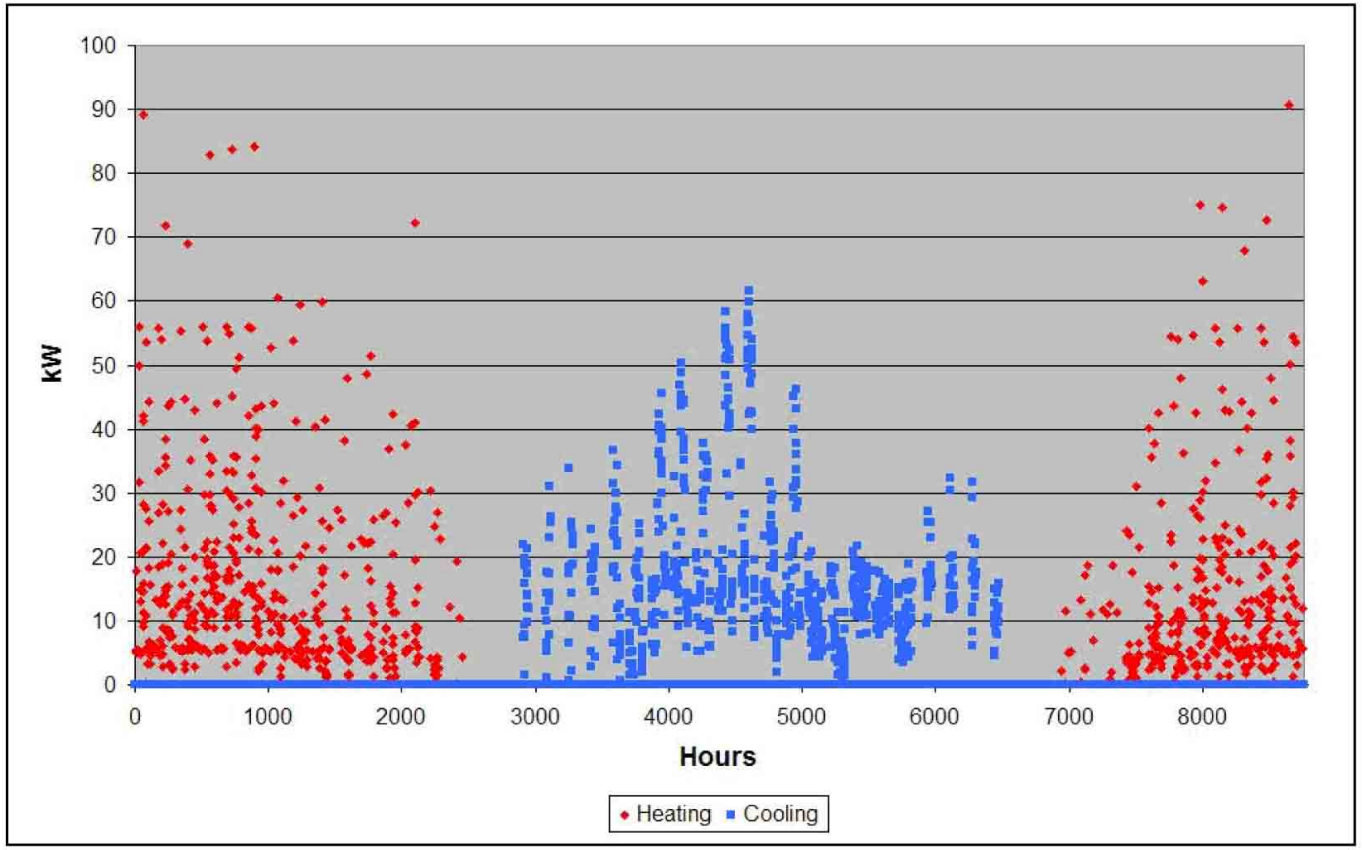


Without light shelf

With light shelf



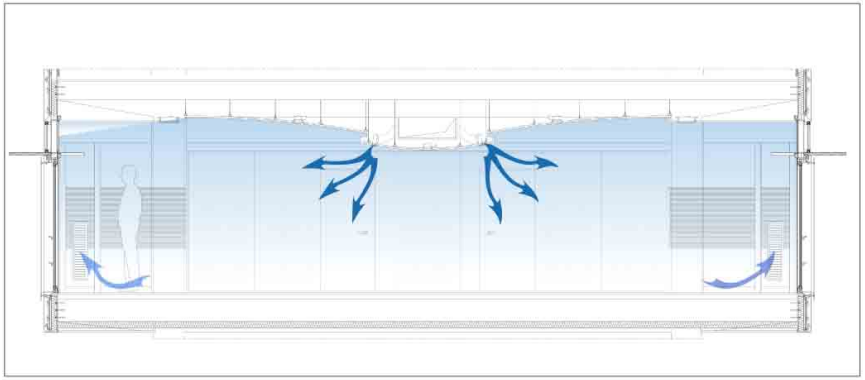
Analisi accurata dei carichi istantanei mediante simulazione

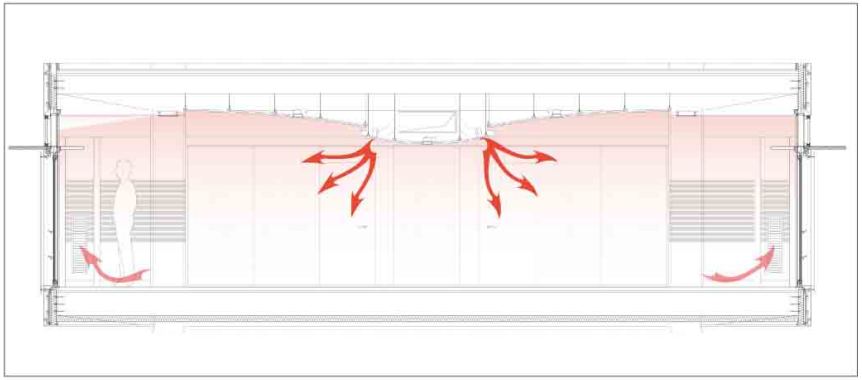


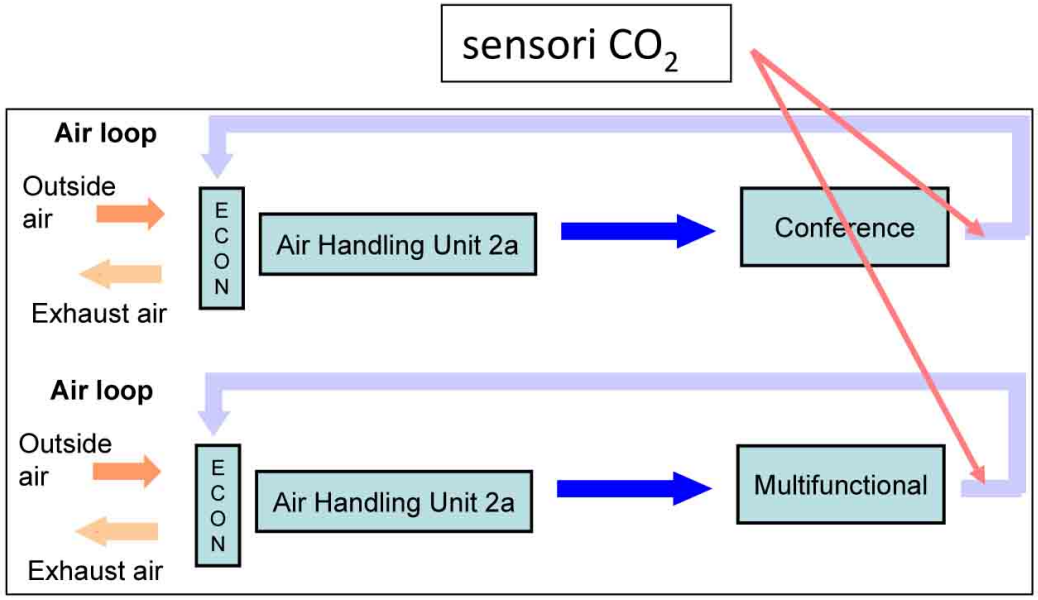
Per non sovradimensionare inutilmente l'impianto

Portata dell'aria di rinnovo variabile in funzione del numero di persone

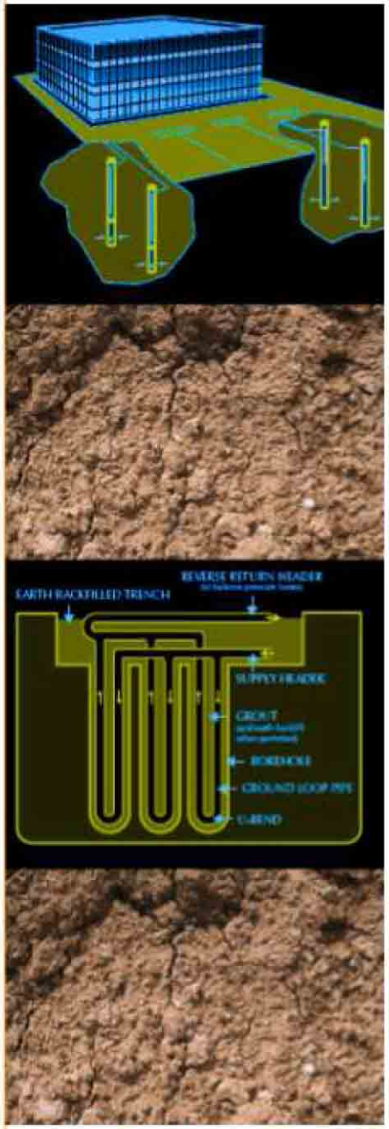
Conferenza and Multifunzionale







VERTICAL GROUND HEAT EXCHANGERS



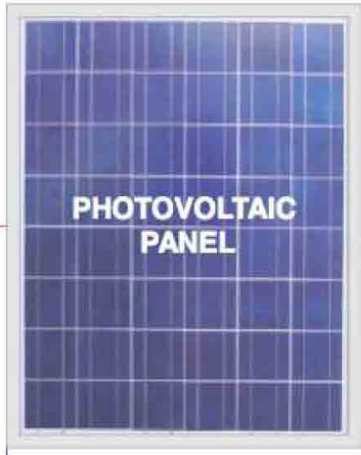
PHOTOVOLTAIC CANOPY

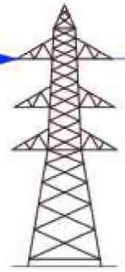
WEST ELEVATION

PHOTOVOLTAIC CANOPY

SOUTH ELEVATION

PHOTOVOLTAIC SOUTH FACADE





GRID

ELECTRIC END USES

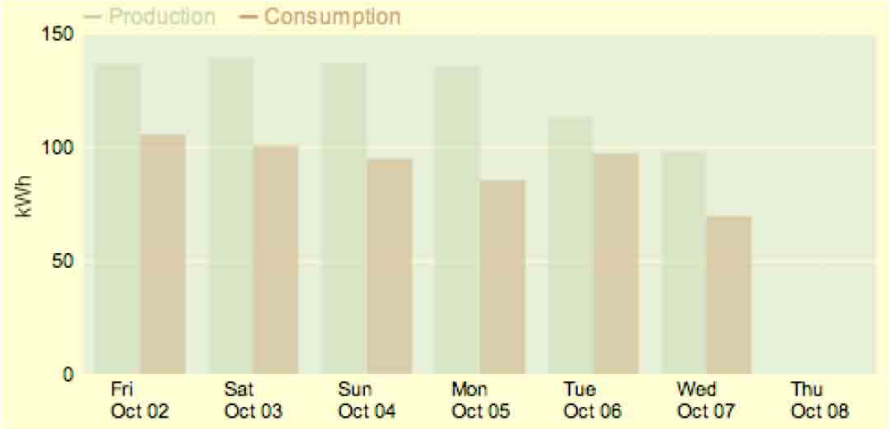
ELECTRIC POWER

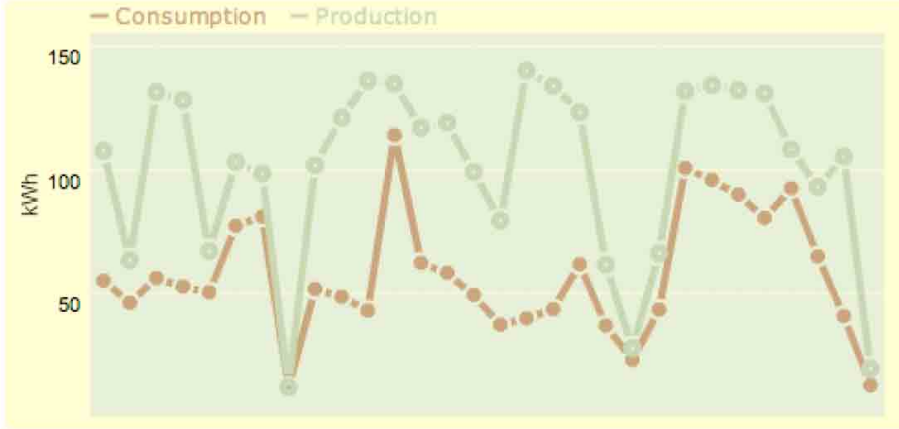
PLANT ROOM

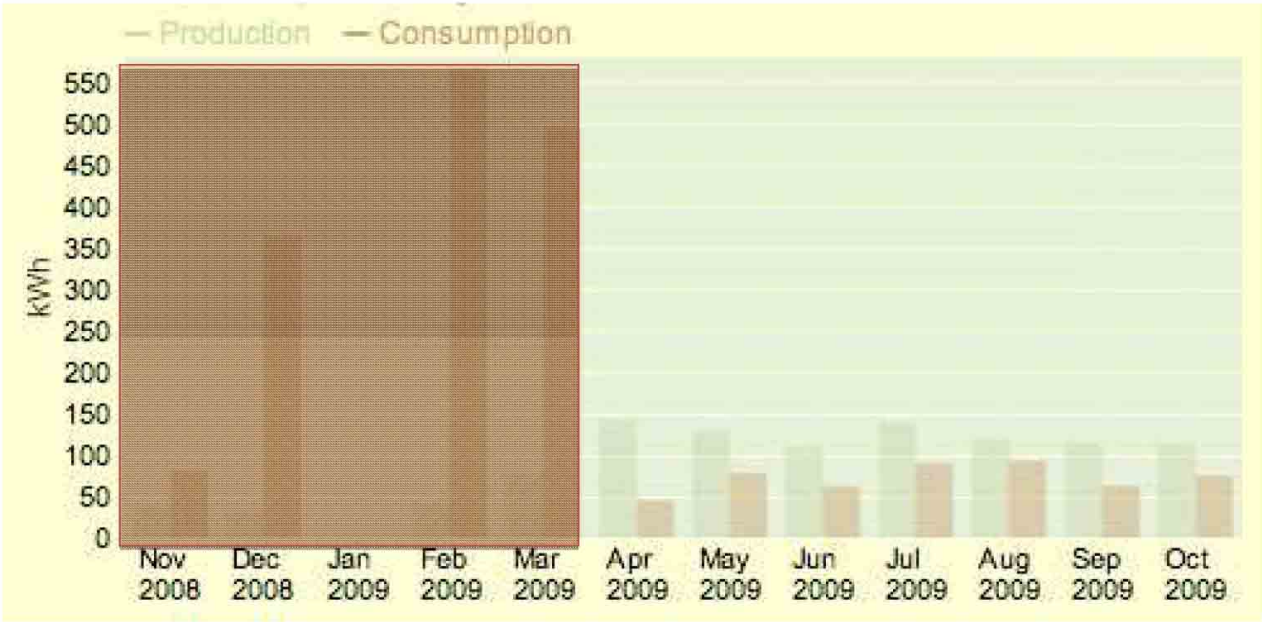
http://www.rec.org

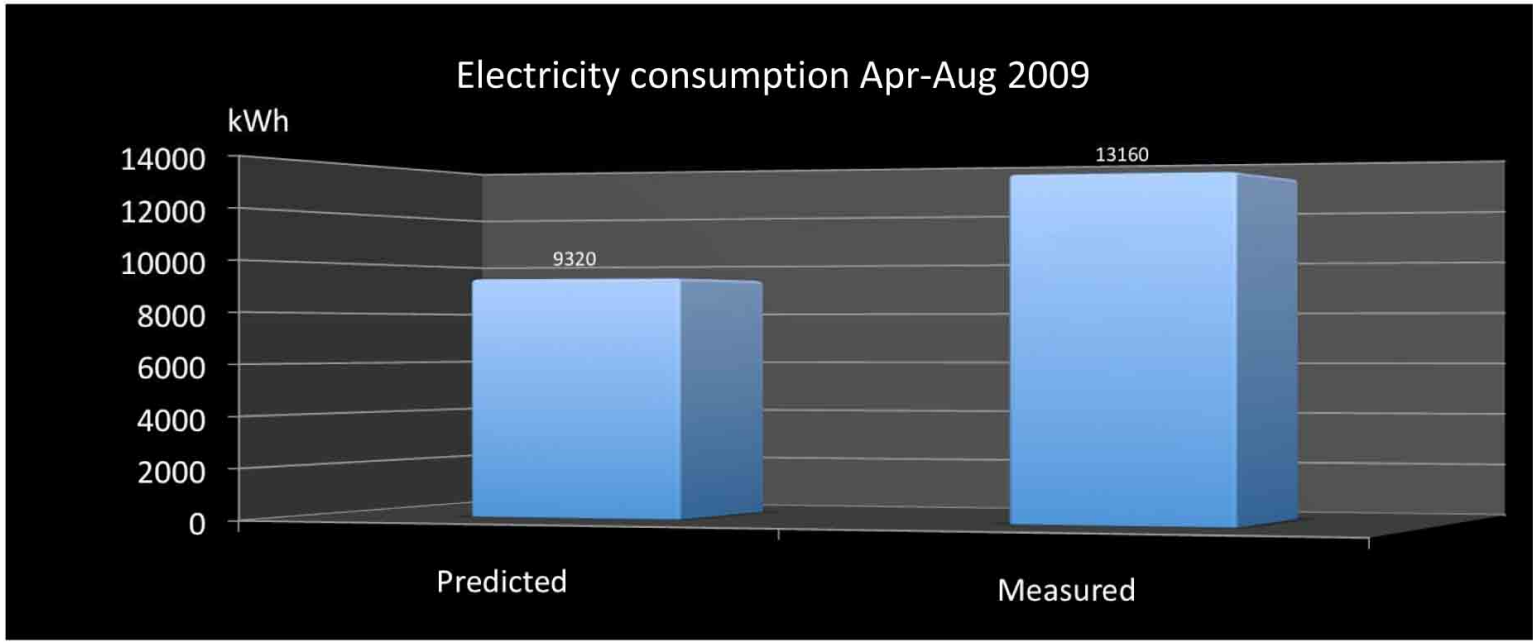
7 Ottobre 2009, ore 14:00

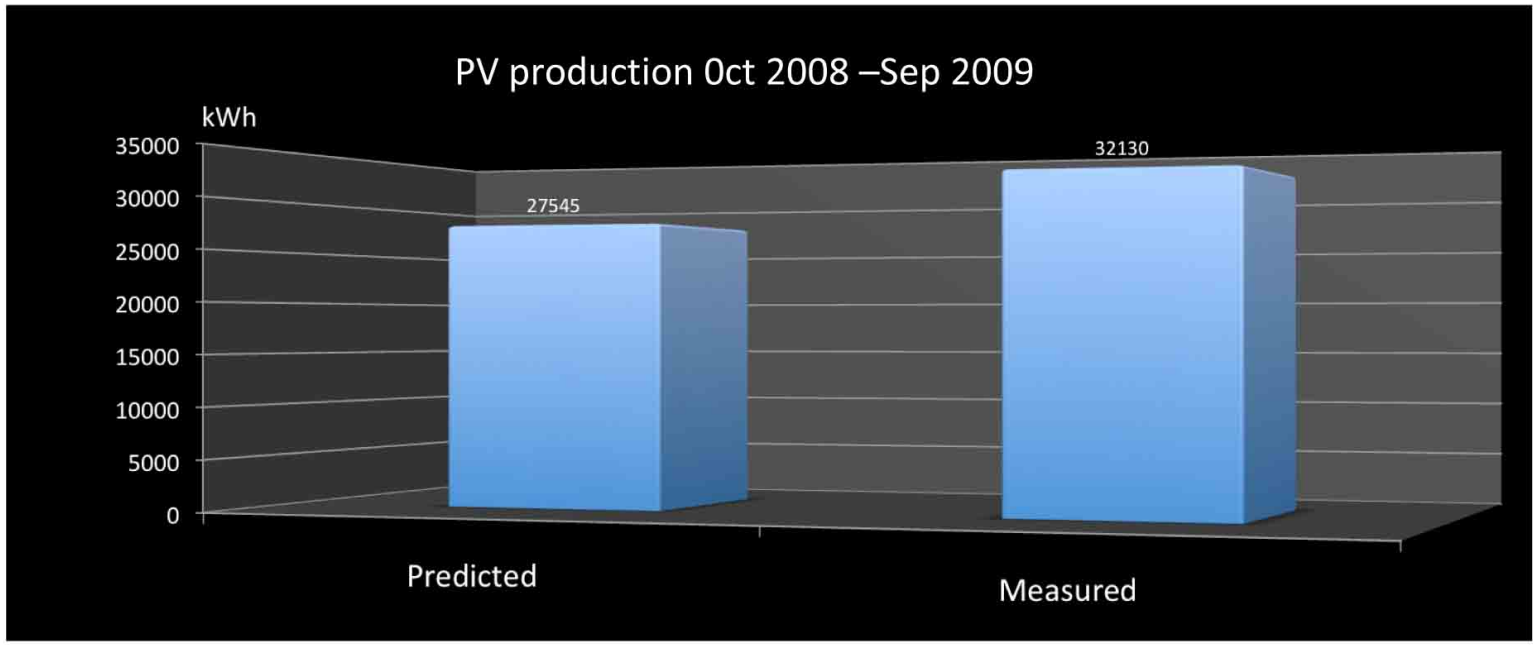
Bilancio energetico








Electricity consumption Apr-Aug 2009
kWh
14000
12000
10000
8000
6000
4000
2000
0
9320
13160
Predicted
Measured


PV production 0ct 2008 –Sep 2009
kWh
35000
30000
25000
20000
15000
10000
5000
0
27545
32130
Predicted
Measured

Si prevede che l'edificio consumerà di più del previsto a causa de:

il successo

- L'Impianto funziona anche nel week-end
- Temperatura notturna e nelle zone non usate (18 °C invece di 16 °C a causa dei fiori)

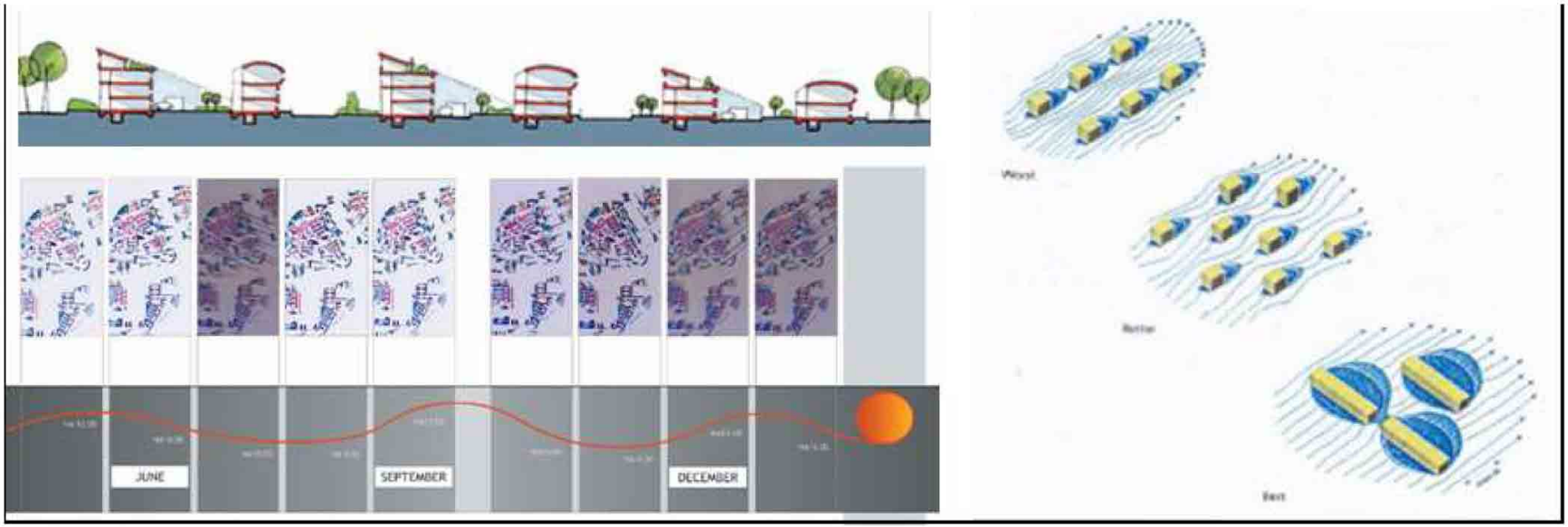
Si stima che la combinazione di questi due fattori debba causare un incremento dei consumi del 50%

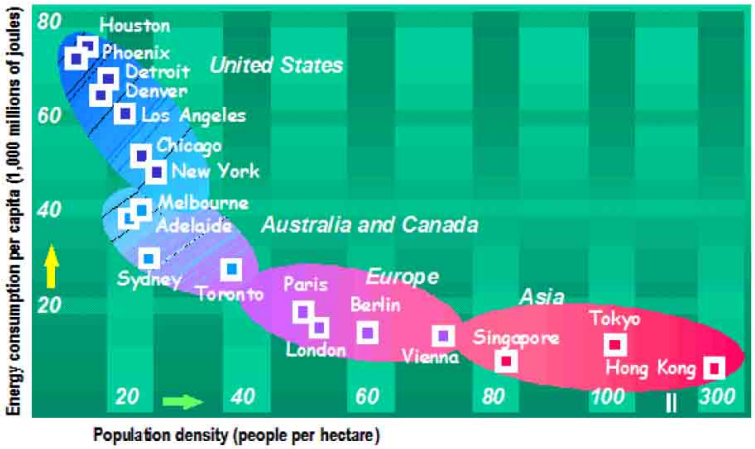
la realizzazione e la gestione non conformi al progetto:

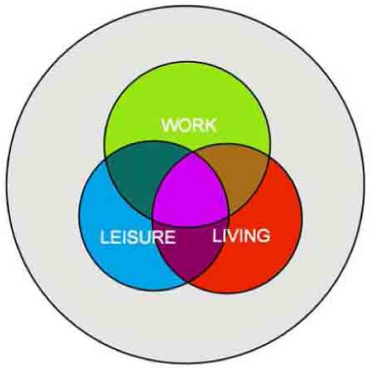
- Temperatura degli ambienti (23 °C invece di 20 °C)
- Taratura delle pompe e delle ventole
- Il sistema di controllo della luce artificiale non è stato realizzato come da progetto

Operare a scala di quartiere o di espansione urbana permette di raggiungere i migliori risultati con i costi più bassi

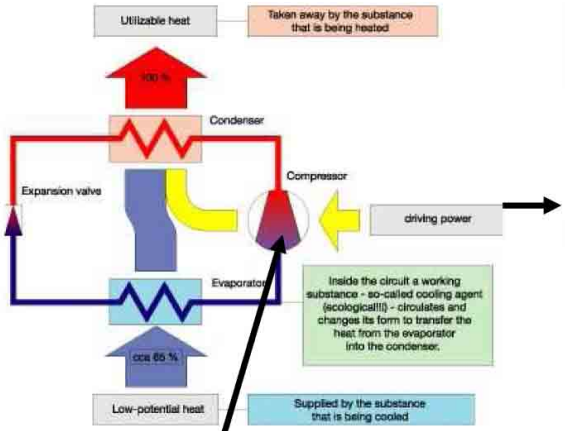
Minimizzare la necessità di energia (to be lean)

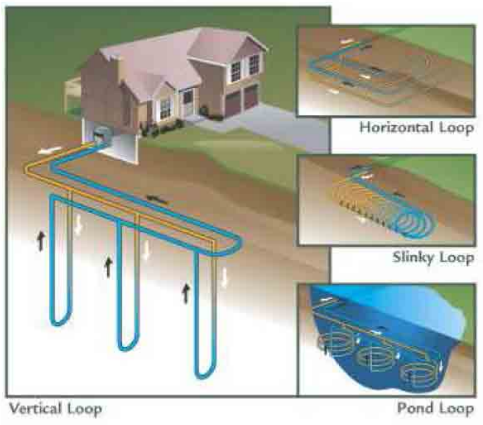




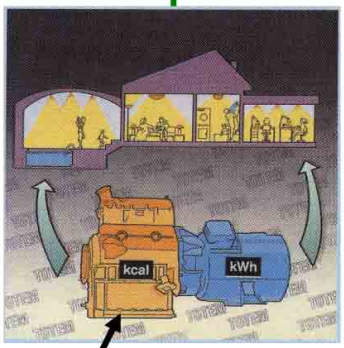


Minimizzare il consumo di energia primaria (to be clean)





Elettricità



Combustibile

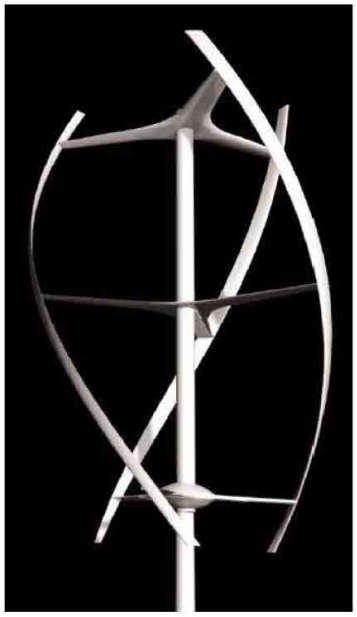
Calore

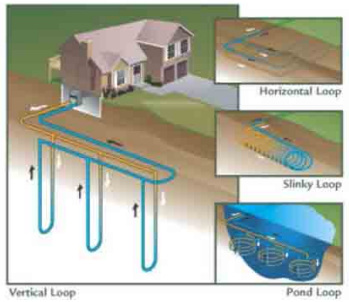
Elettricità

Condizionamento estivo

Riscaldamento e produzione acqua calda

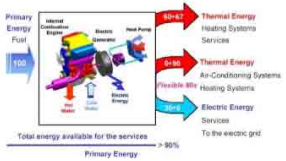
Massimizzare l’uso di fonti rinnovabili (to be green)





To be clean and green

Elettricità

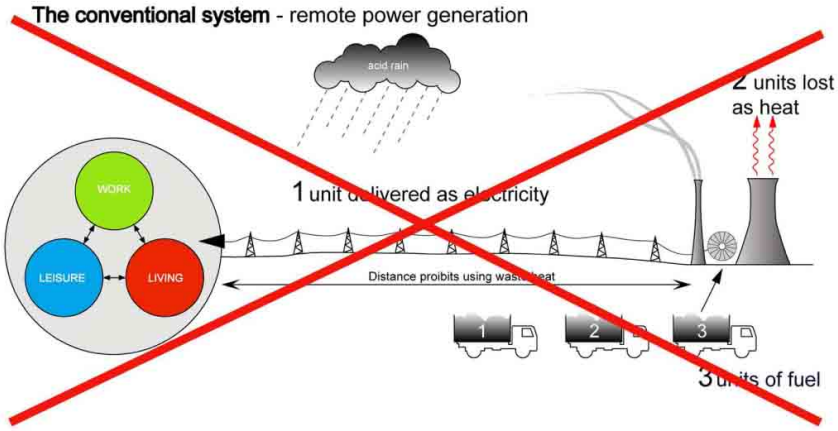


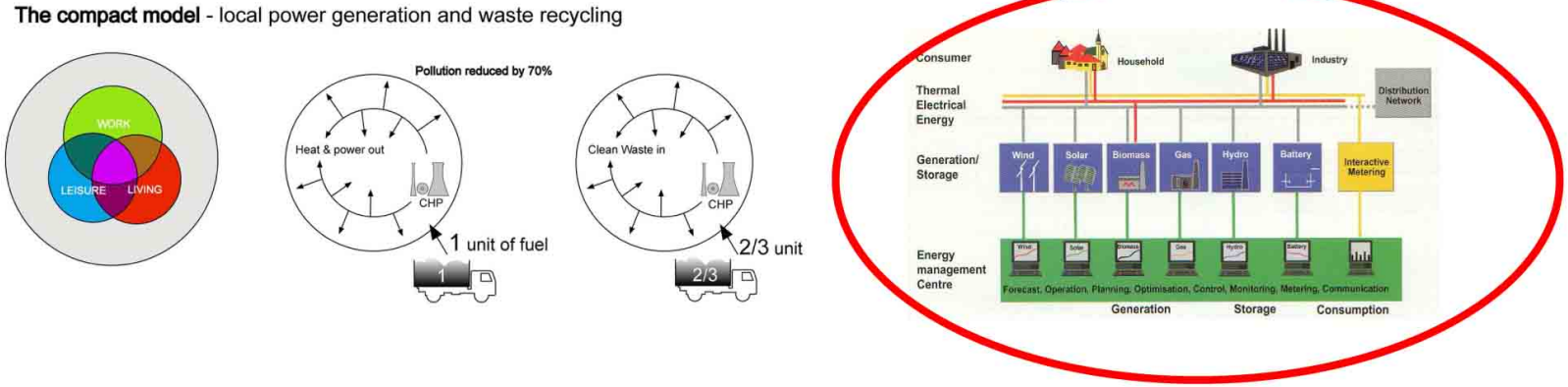
Calore

Condizionamento estivo

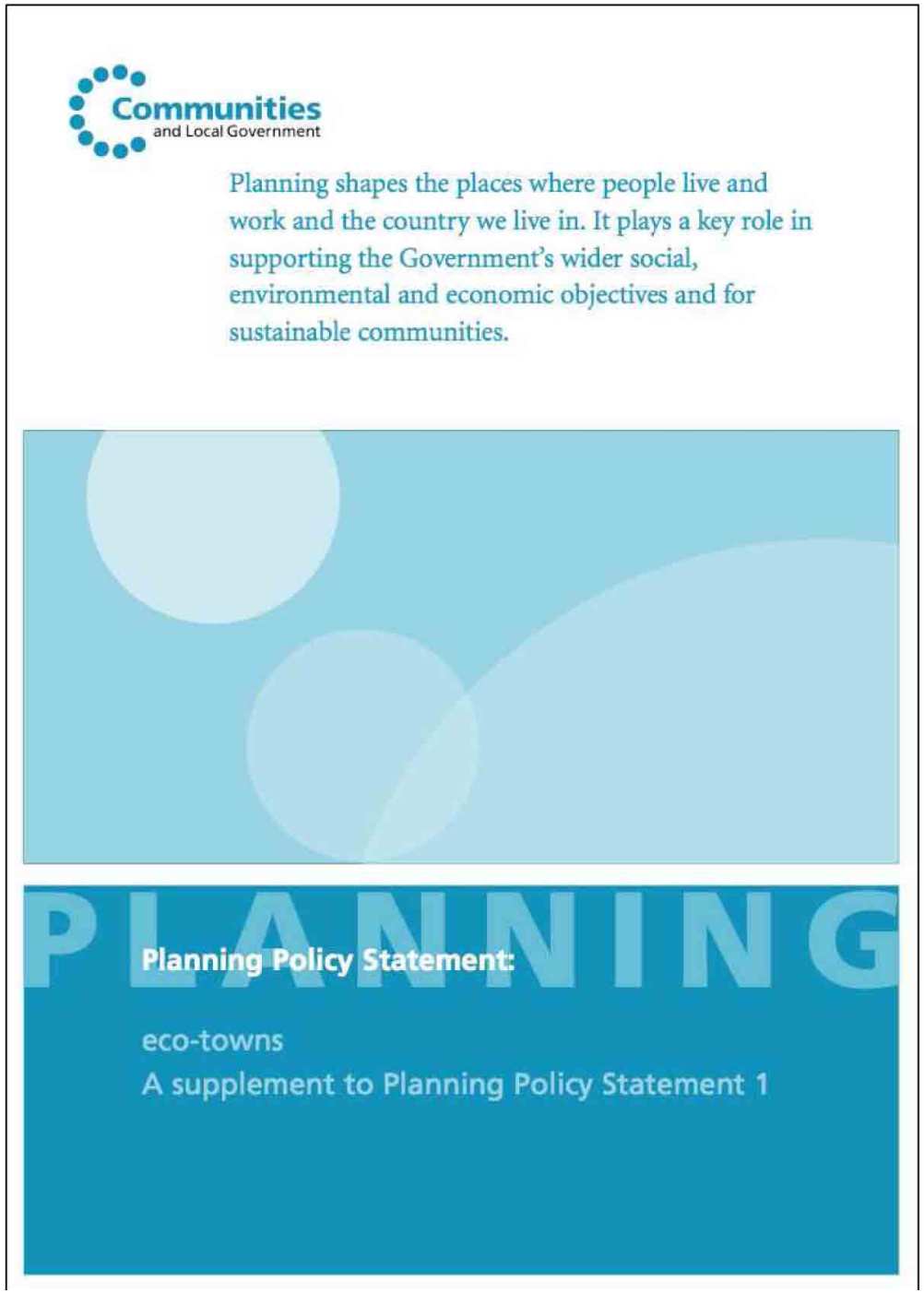
Riscaldamento e produzione acqua calda

Un nuovo sistema energetico





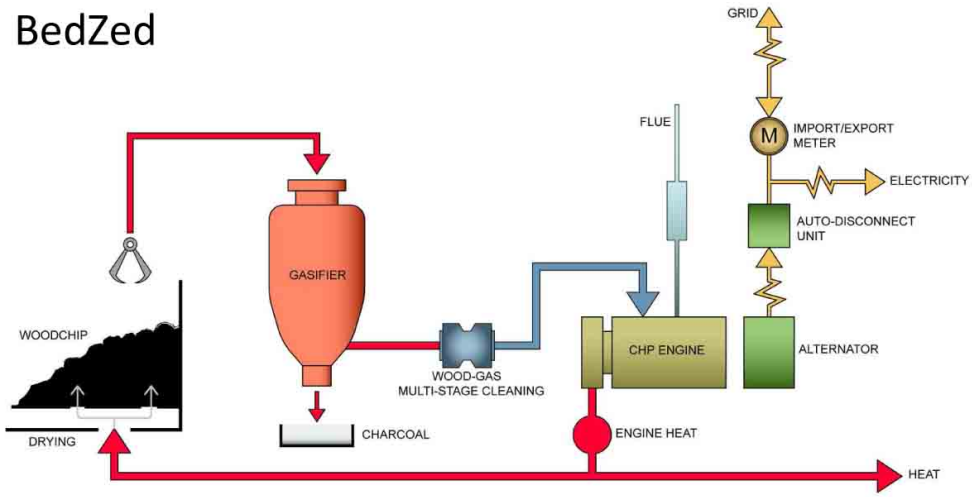
Risorse energetiche distribuite

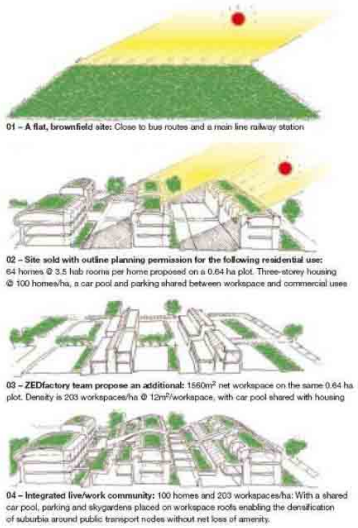


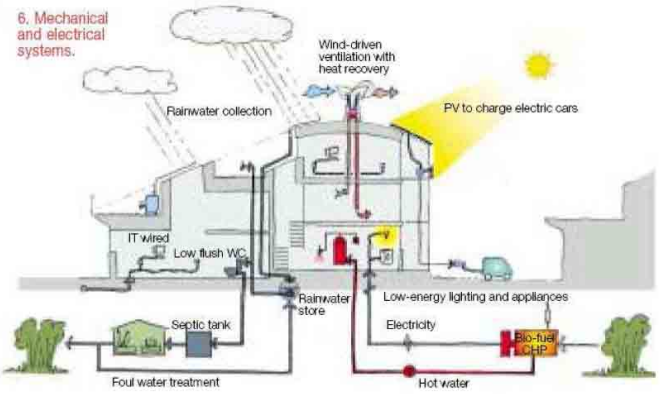
Una eco-città a emissioni zero è quella nella quale le emissioni nette annuali di CO_2 causate da tutti i consumi energetici degli edifici che in essa ricadono sono complessivamente pari a zero o negative

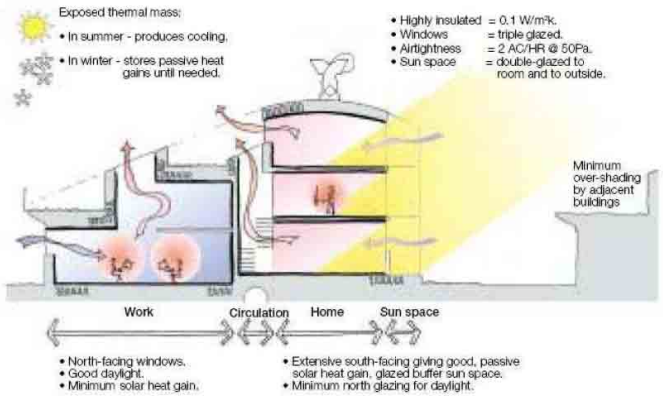
Le eco-città dovrebbero essere comunità sostenibili che sono resilienti e adatte per il cambiamento climatico ormai accettato come inevitabile

BedZed


GRID
FLUE
M
IMPORT/EXPORT METER
ELECTRICITY
AUTO-DISCONNECT UNIT
GASIFIER
WOODCHIP
WOOD-GAS MULTI-STAGE CLEANING
CHP ENGINE
ALTERNATOR
DRYING
CHARCOAL
ENGINE HEAT
HEAT


01 – A flat, brownfield site: Close to bus routes and a main line railway station
02 – Site sold with outline planning permission for the following residential use: 64 homes @ 3.5 hab rooms per home proposed on a 0.64 ha plot. Three-storey housing @ 100 homes/ha, a car pool and parking shared between workspace and commercial uses
03 – ZEDfactory team propose an additional: 1560m² net workspace on the same 0.64 ha plot. Density is 203 workspaces/ha @ 12m²/workspace, with car pool shared with housing
04 – Integrated live/work community: 100 homes and 203 workspaces/ha: With a shared car pool, parking and skygardens placed on workspace roofs enabling the densification of suburbia around public transport nodes without net loss of amenity.


6. Mechanical and electrical systems.
Wind-driven ventilation with heat recovery
Rainwater collection
PV to charge electric cars
IT wired
Low flush WC
Rainwater store
Low-energy lighting and appliances
Electricity
Septic tank
Bio-fuel CHP
Foul water treatment
Hot water


Exposed thermal mass:
• In summer - produces cooling.
• In winter - stores passive heat gains until needed.
• Highly insulated = 0.1 W/m²k.
• Windows = triple glazed.
• Airtightness = 2 AC/HR @ 50Pa.
• Sun space = double-glazed to room and to outside.
Minimum over-shading by adjacent buildings
Work
Circulation
Home
Sun space
• North-facing windows.
• Good daylight.
• Minimum solar heat gain.
• Extensive south-facing giving good, passive solar heat gain, glazed buffer sun space.
• Minimum north glazing for daylight.

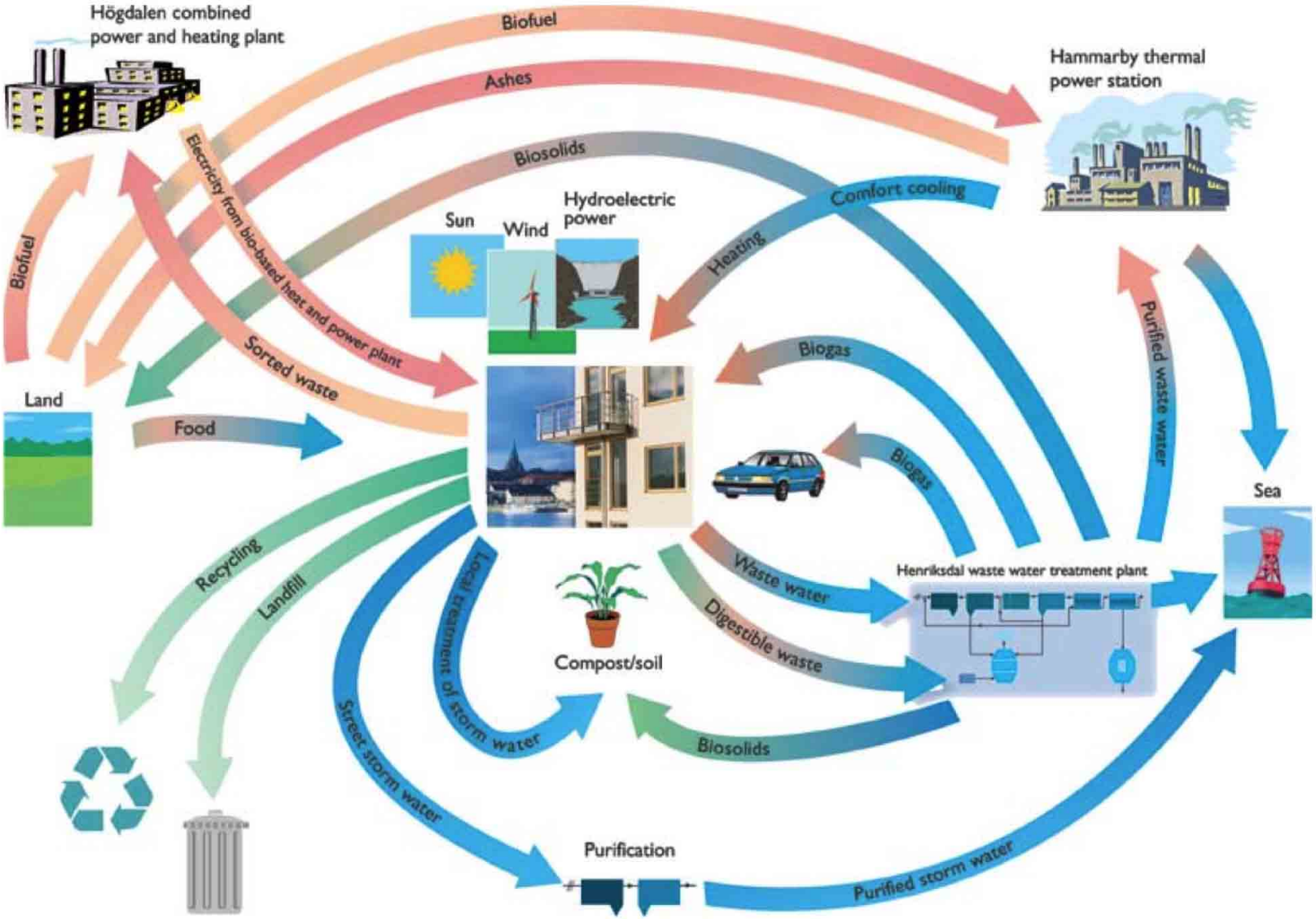
Insediamenti urbani sostenibili


Malmö, Svezia

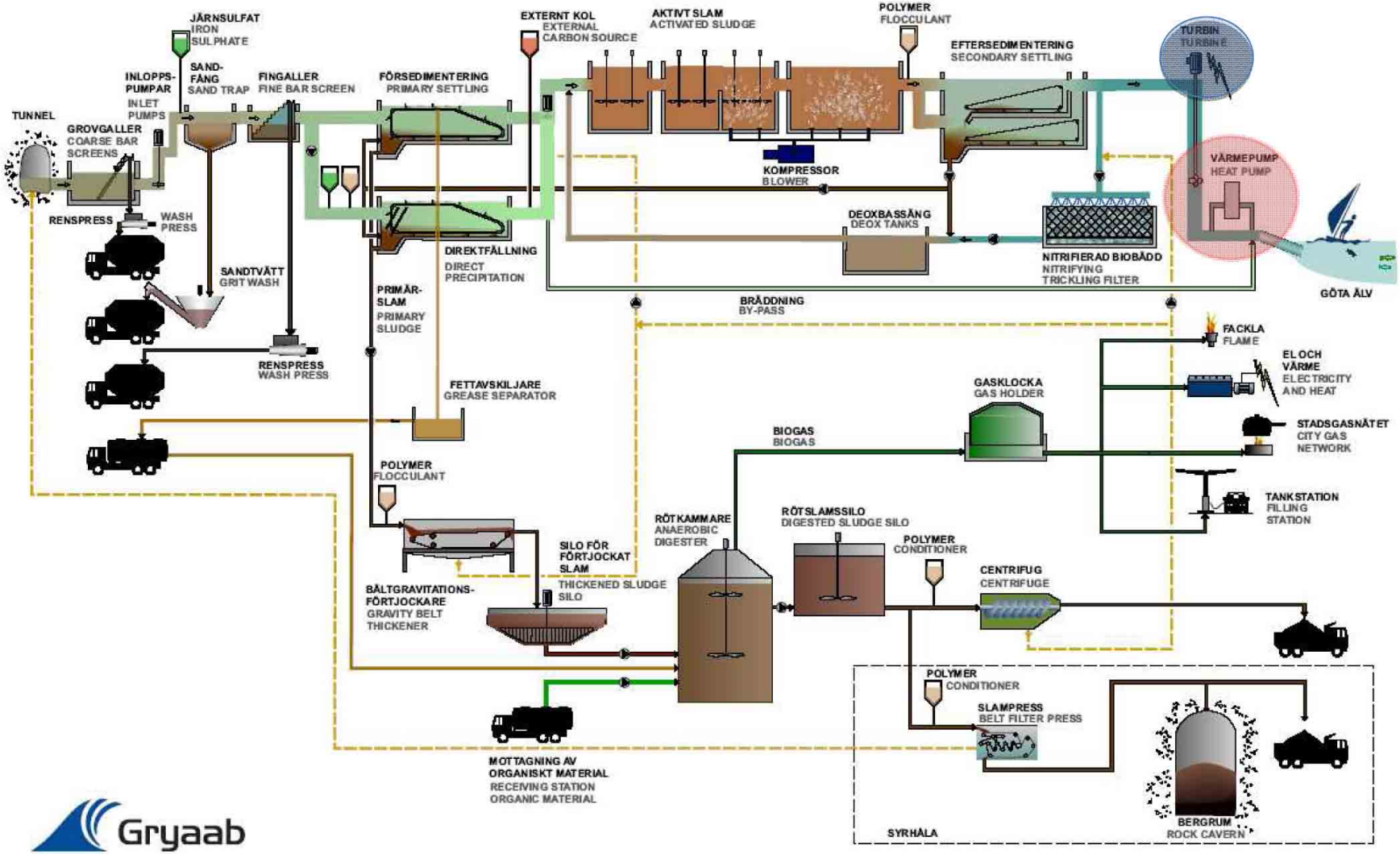

Masdar, Abu Dhabi


Dongtan, Cina

Huai Rou, Cina



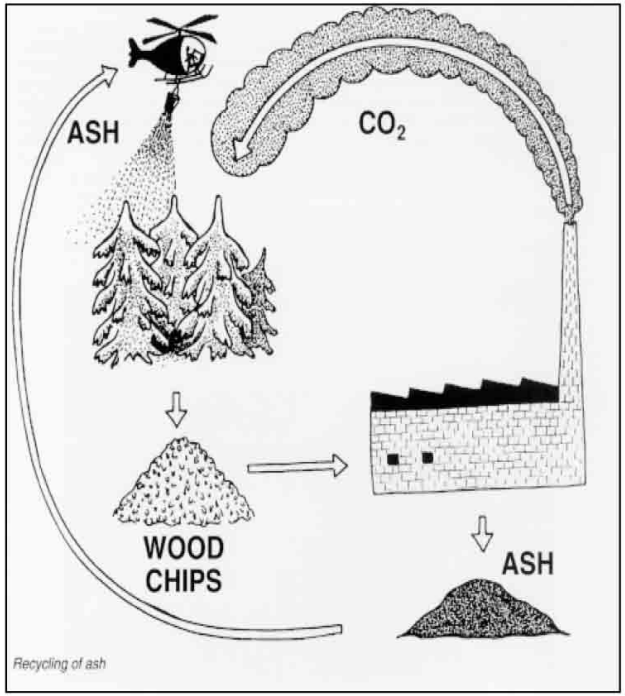
Hammarby, Stoccolma



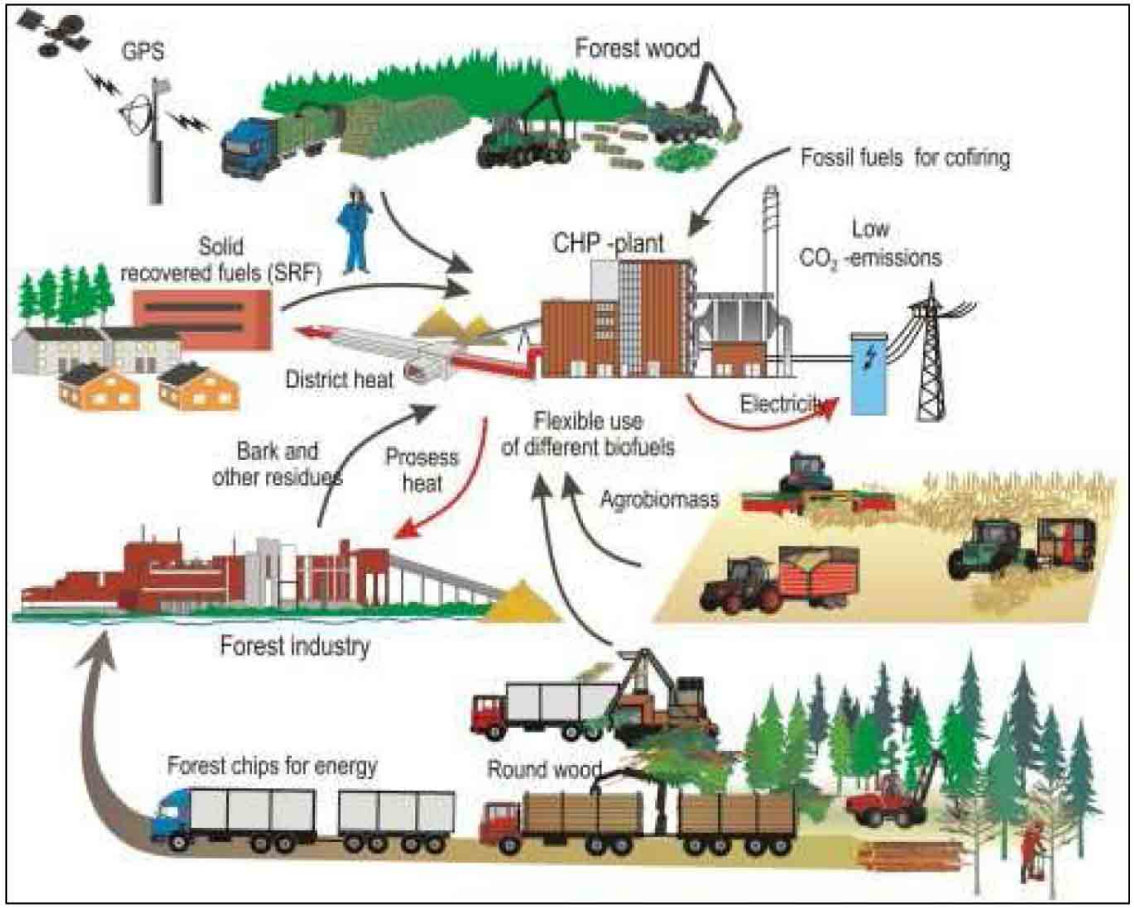
Gryaab

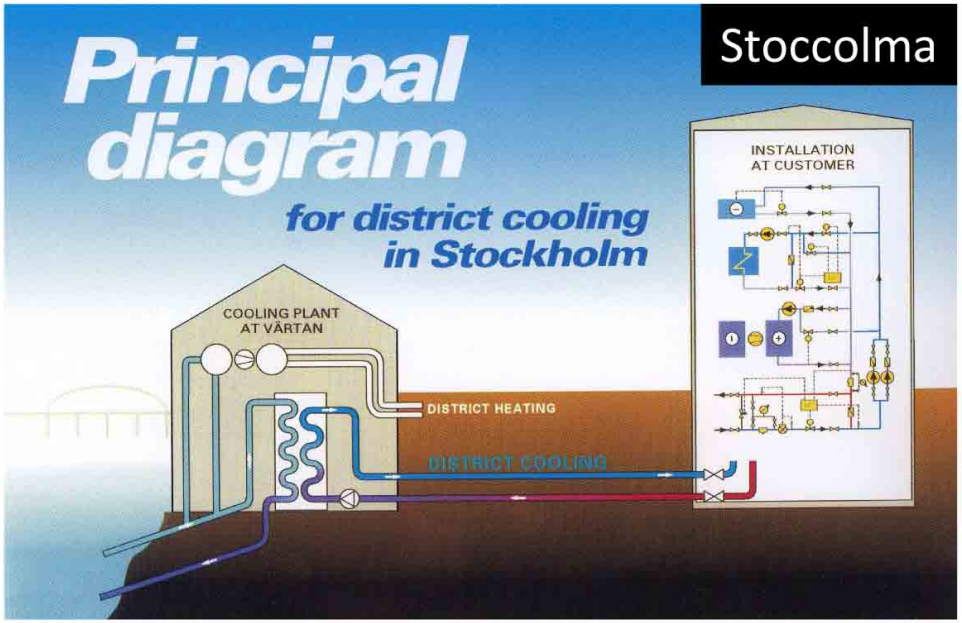
Ryaverket – processchema

Goteborg, Svezia

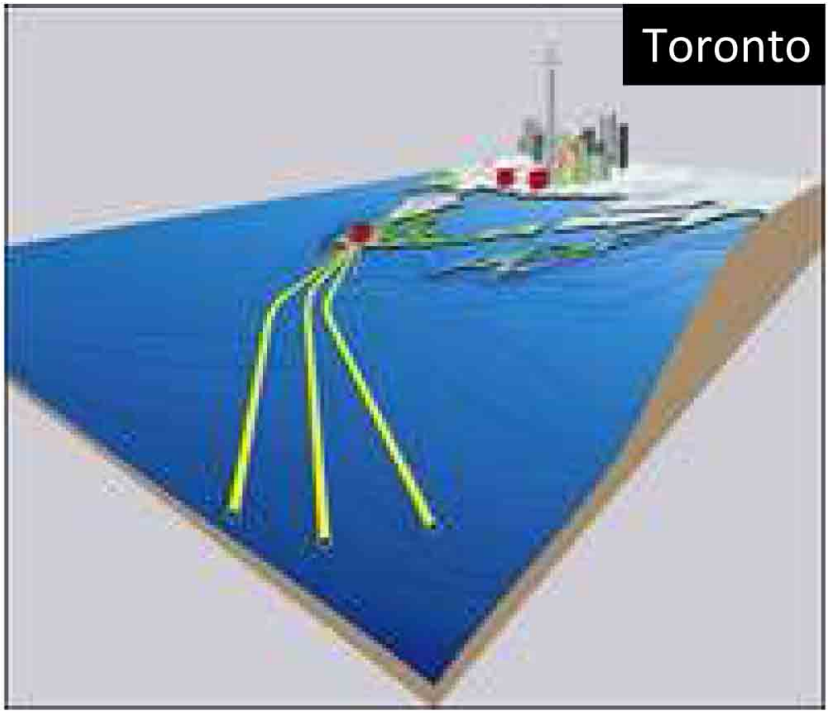


Växjö, Svezia

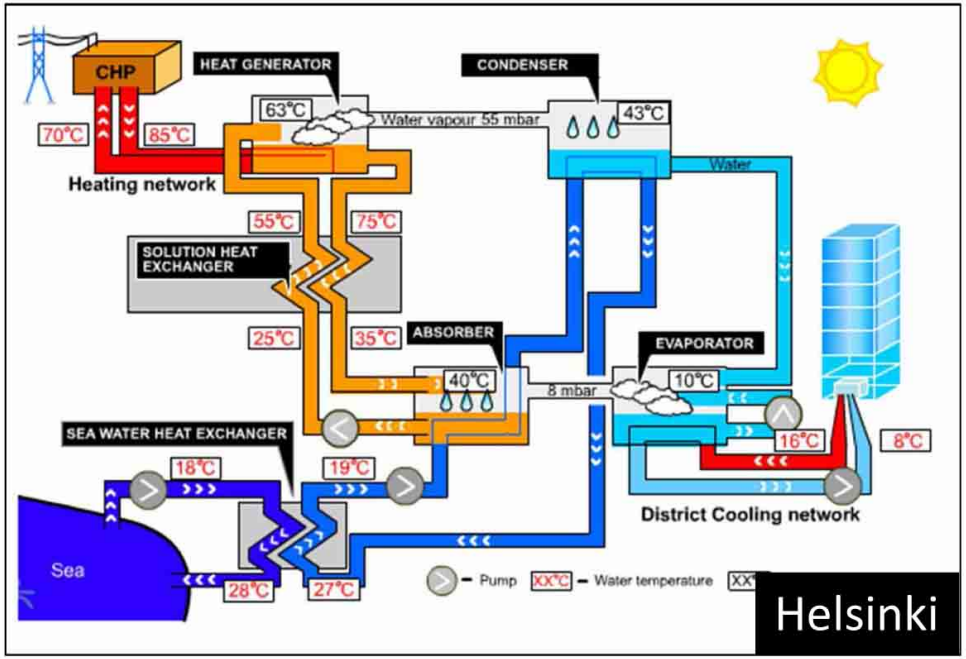




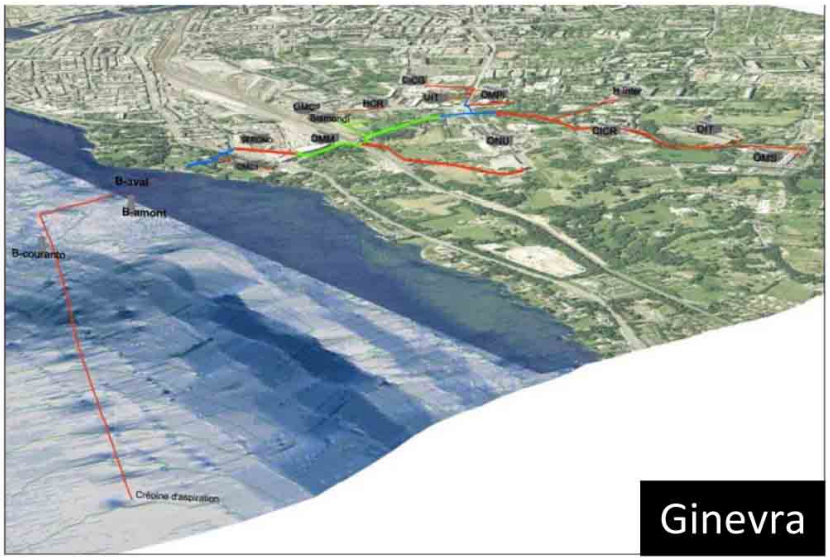
Stoccolma



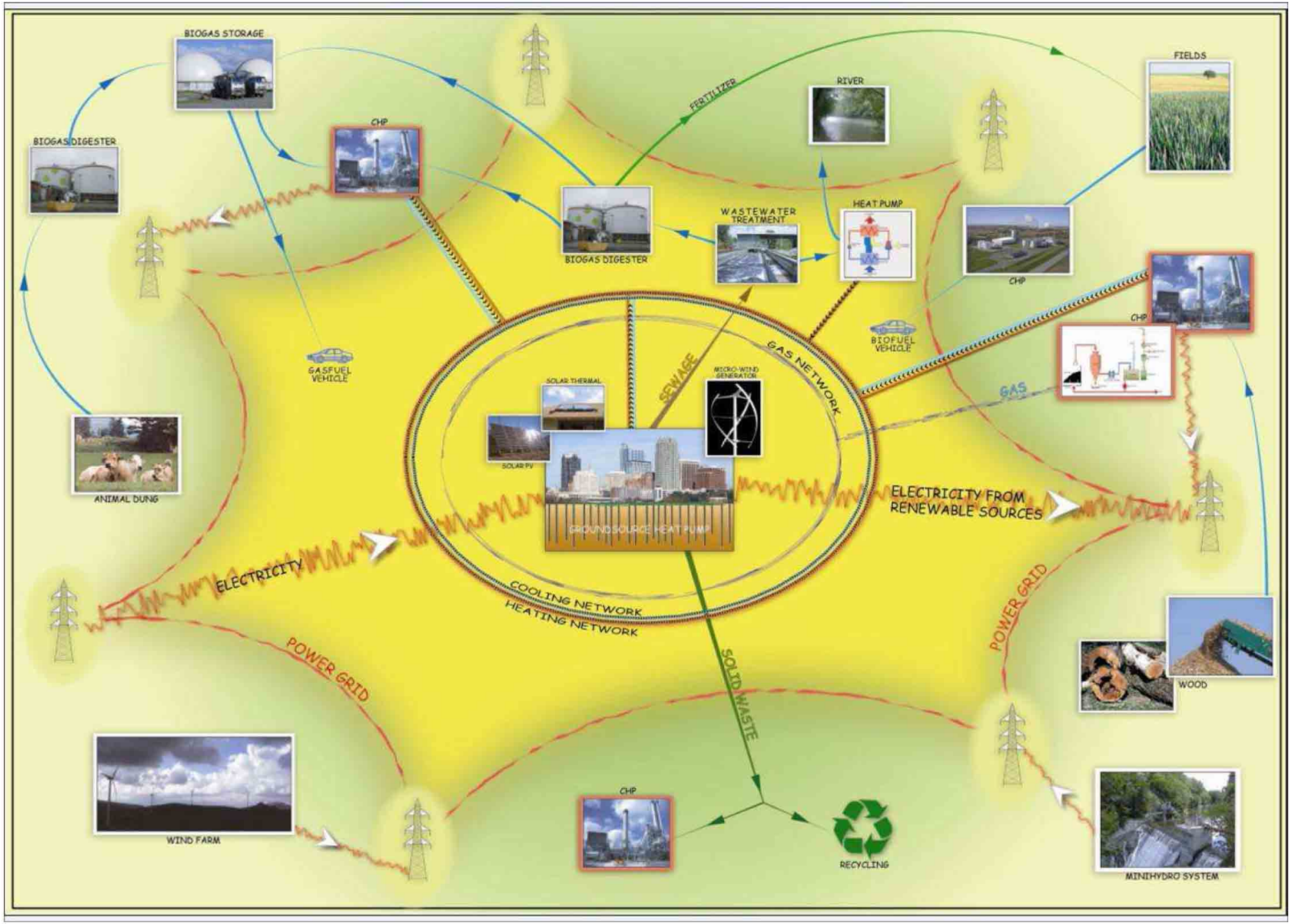
Toronto

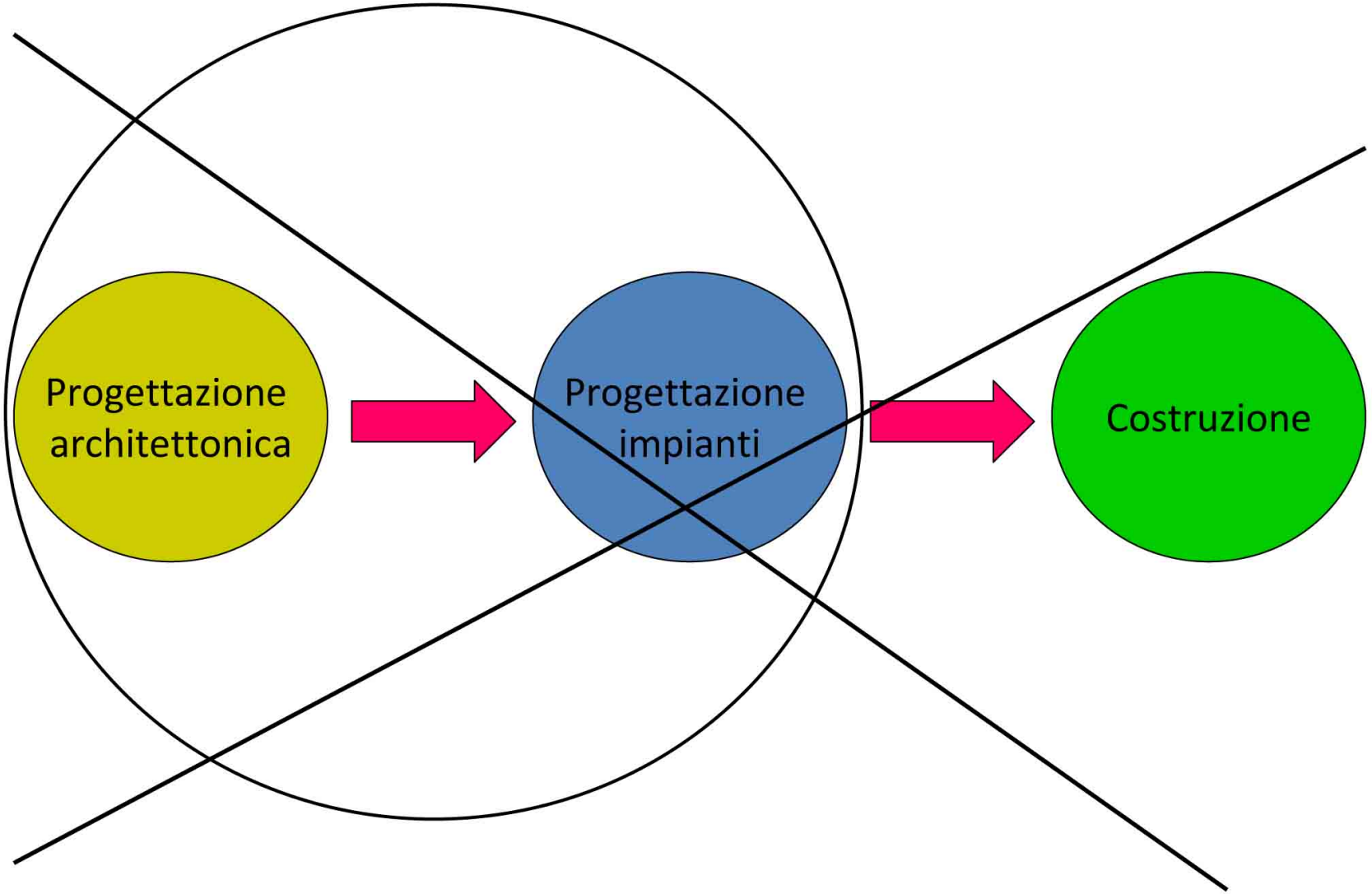


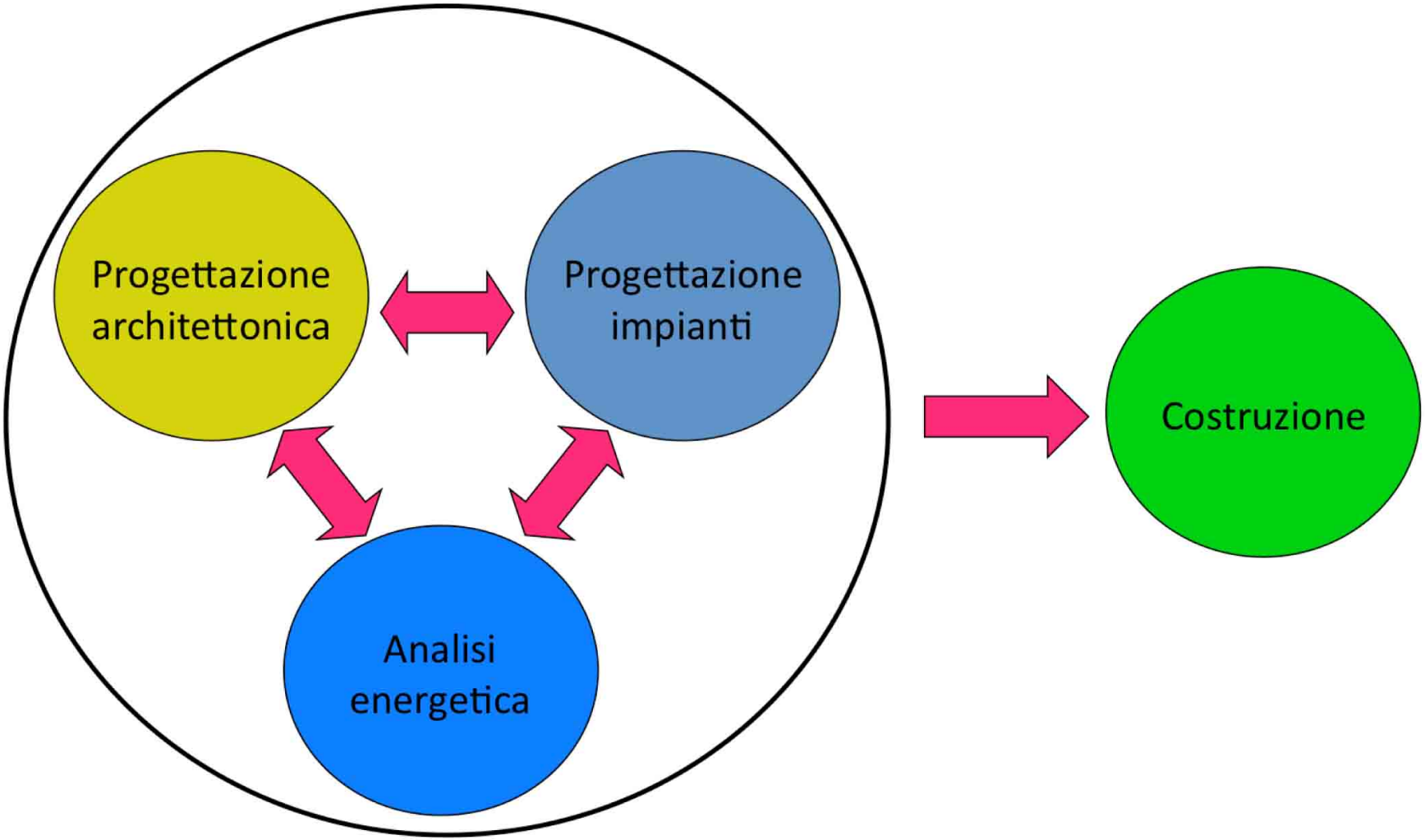
Helsinki

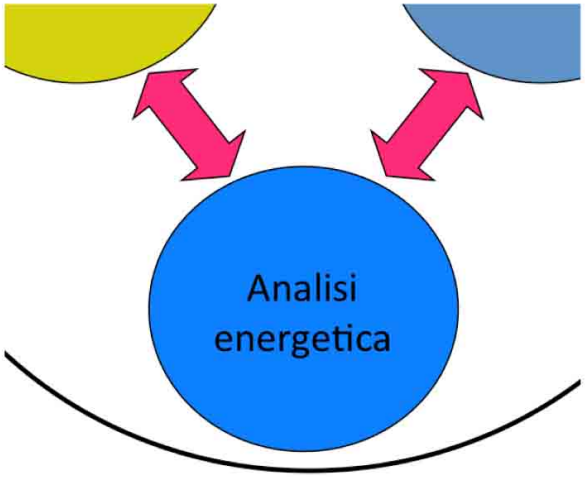


Ginevra


BIOGAS STORAGE
BIOGAS DIGESTER
CHP
FERTILIZER
RIVER
FIELDS
WASTEWATER TREATMENT
HEAT PUMP
BIOGAS DIGESTER
CHP
GASFUEL VEHICLE
BIOFUEL VEHICLE
CHP
SOLAR THERMAL
MICRO-WIND GENERATION
SEWAGE
GAS NETWORK
GAS
SOLAR PV
GROUND SOURCE HEAT PUMP
ANIMAL DUNG
ELECTRICITY
ELECTRICITY FROM RENEWABLE SOURCES
COOLING NETWORK
HEATING NETWORK
POWER GRID
POWER GRID
SOLID WASTE
WOOD
WIND FARM
CHP
RECYCLING
MINIHYDRO SYSTEM


Progettazione architettonica
Progettazione impianti
Costruzione

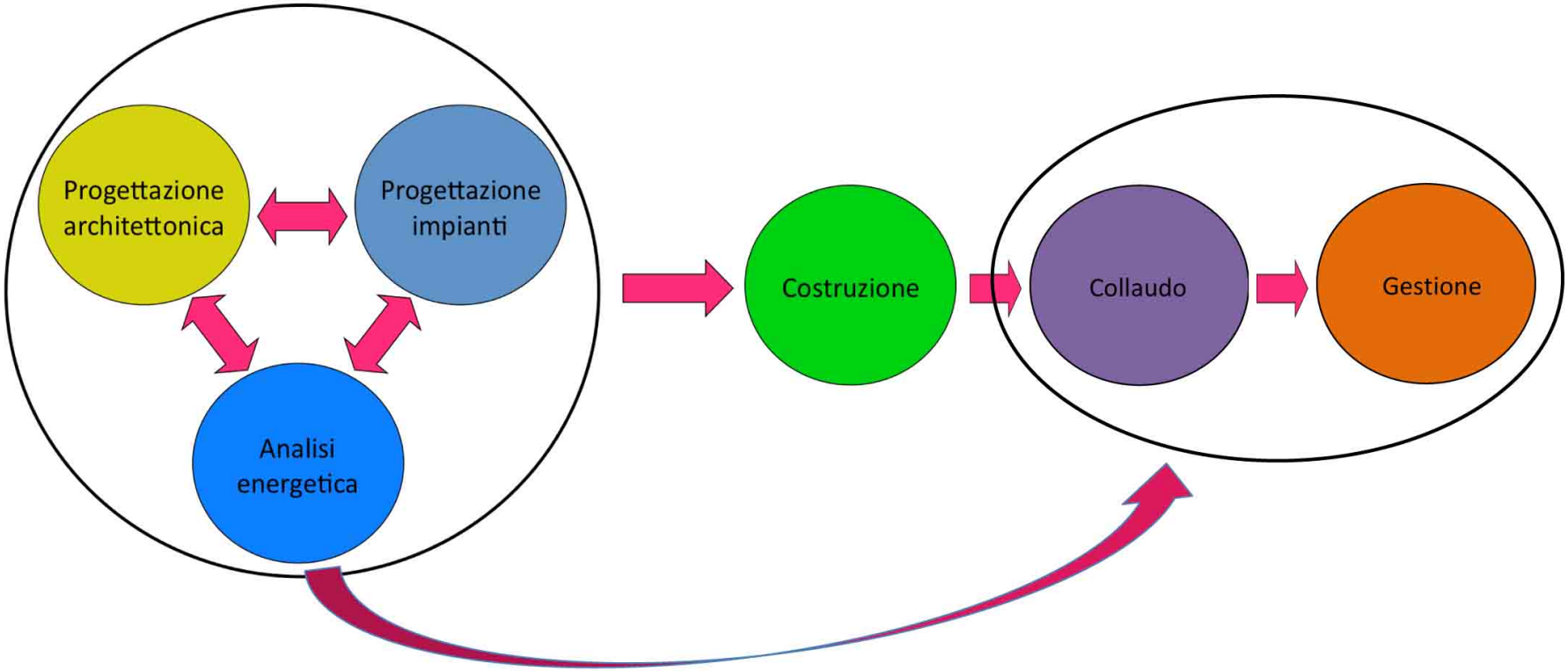

Progettazione architettonica
Progettazione impianti
Analisi energetica
Costruzione



- Termo-fisica degli edifici
- Illuminazione naturale e artificiale
- Acustica ambientale
- Fluidodinamica
- Impianti di conversione dell'energia
- Impianti di climatizzazione

+ un po' di storia dell'architettura

- Modelli di simulazione dinamica del comportamento energetico degli edifici
- Modelli di simulazione della illuminazione naturale negli ambienti (ray tracing)
- Modelli di simulazione dei flussi d'aria (CFD)
- Metodi di calcolo delle prestazioni dei sistemi di conversione dell'energia (cogenerazione, solare termico e fotovoltaico, eolico)
- Metodi di calcolo delle prestazioni degli impianti di climatizzazione


Progettazione architettonica
Progettazione impianti
Analisi energetica
Costruzione
Collaudo
Gestione

Conclusioni

Un insediamento a emissioni zero non è un'utopia, né tecnica né economica. È anche un obiettivo obbligato.

Occorre che si evolva non solo la fase di progettazione, ma anche quella costruzione e di gestione.

Per accelerare questa evoluzione (e bisogna accelerarla) c'è solo un modo: moltiplicare le esperienze, attraverso obblighi e incentivi. A partire dagli edifici di proprietà pubblica.

La creazione di competenze e l'incentivo all'innovazione tecnologica che deriva dalla diffusione degli edifici a emissioni zero darebbe luogo a una fortissima ricaduta positiva sulla riduzione dei consumi nell'edilizia esistente

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