

**Il contributo degli edifici alla Sostenibilità delle Città:
approccio metodologico olistico, sviluppi della Normativa Tecnica**

**ing. Pasquale Capezzuto
Presidente Commissione Tecnica UNI/TC058
“Citta, Comunità e Infrastrutture sostenibili”**

Sviluppo Sostenibile

Global



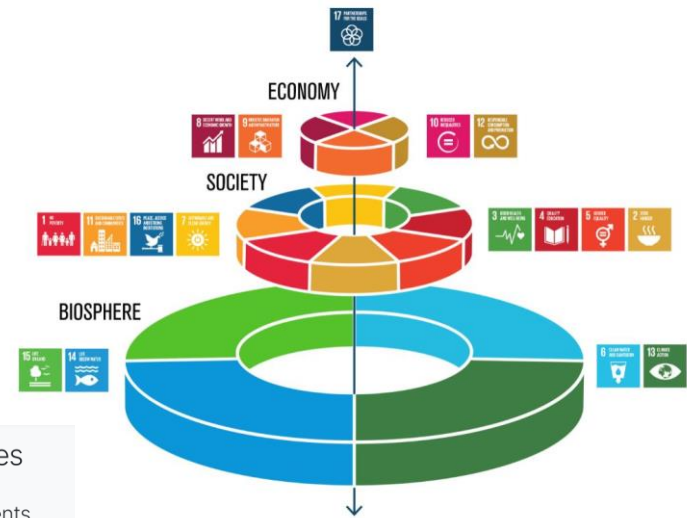
SUSTAINABLE DEVELOPMENT GOALS
17 GOALS TO TRANSFORM OUR WORLD



Local



← Sustainable Development Goals
Goal 11: Sustainable Cities and Communities
Make cities and human settlements inclusive, safe, resilient and sustainable



Policies Europee per la Transizione Verde e Digitale

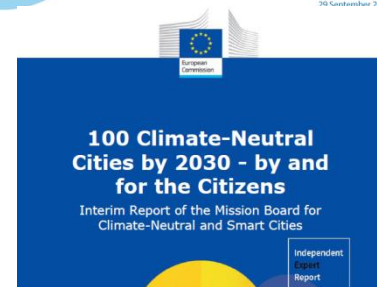


AN ACTION PLAN FOR THE RENOVATION WAVE:
COLLECTIVELY ACHIEVING SUSTAINABLE BUILDINGS IN EUROPE

URBAN EUROPE



EUROPE TOWARDS POSITIVE ENERGY DISTRICTS



La Transizione Digitale a sostegno

COMUNICAZIONE DELLA COMMISSIONE AL PARLAMENTO EUROPEO,
AL CONSIGLIO, AL COMITATO ECONOMICO E SOCIALE EUROPEO E
AL COMITATO DELLE REGIONI

SOSTEGNO ALLA TRANSIZIONE VERDE

PLASMARE IL FUTURO
DIGITALE DELL'EUROPA

Febbraio 2020
#DigitalEU

Le tecnologie digitali sono fondamentali affinché l'UE consegua la neutralità climatica entro il 2050, obiettivo fissato nel Green Deal europeo.



Reti energetiche



Agricoltura di precisione



Mobilità e trasporti



Edifici intelligenti



Spazi di dati verdi



Il potere dei dati



Internet of things (IoT)



Smart meters/AMI



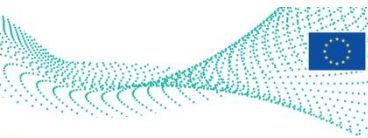
Energy Management Systems



Mobile Services/ Apps



Communic. Technology/ 5G



Global Gateway

Global Gateway
€300 bilioni tra 2021 and 2027

Il contributo degli edifici alla sostenibilità delle Città

Connettività per un mercato unico digitale competitivo: verso una società dei Gigabit europea

Proposta di

DECISIONE DEL PARLAMENTO EUROPEO E DEL CONSIGLIO

che istituisce il programma strategico per il 2030 "Percorso per il decennio digitale"

COMUNICAZIONE DELLA COMMISSIONE AL PARLAMENTO EUROPEO,
AL CONSIGLIO, AL COMITATO ECONOMICO E SOCIALE EUROPEO E
AL COMITATO DELLE REGIONI

Bussola per il digitale 2030: il modello europeo per il decennio digitale

**5G FOR SMART
COMMUNITIES
(5G4SC)**



Pasquale Capezzuto

Smart Energy System



Renewable Energy



System Integration

Optimisation of renewable energy production and usage



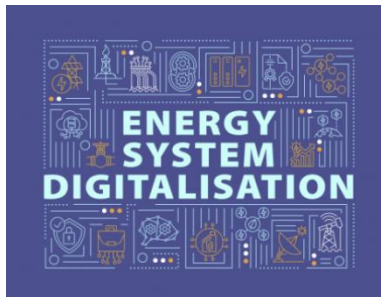
Bi-directional EV-charging

Smart Home and Buildings



Greening the Grid

The green, resilient, secure and affordable energy system of tomorrow is digital









Seamlessly integrating energy devices and systems into smart homes, buildings and grids

Empowering consumers to become active stakeholders in the electricity ecosystem

Better managing fluctuating supply and demand creates a starring role for renewables

Digital technologies contributing to the energy system's transformation:

-  Artificial Intelligence (AI)
-  Internet of Things (IoT)
-  Decentralised Edge Intelligence
-  5G Connectivity
-  High-Performance Computing (HPC)
-  Blockchain

COMUNICAZIONE DELLA COMMISSIONE AL PARLAMENTO EUROPEO, AL CONSIGLIO, AL COMITATO ECONOMICO E SOCIALE EUROPEO E AL COMITATO DELLE REGIONI

Digitalizzare il sistema energetico - Piano d'azione dell'UE

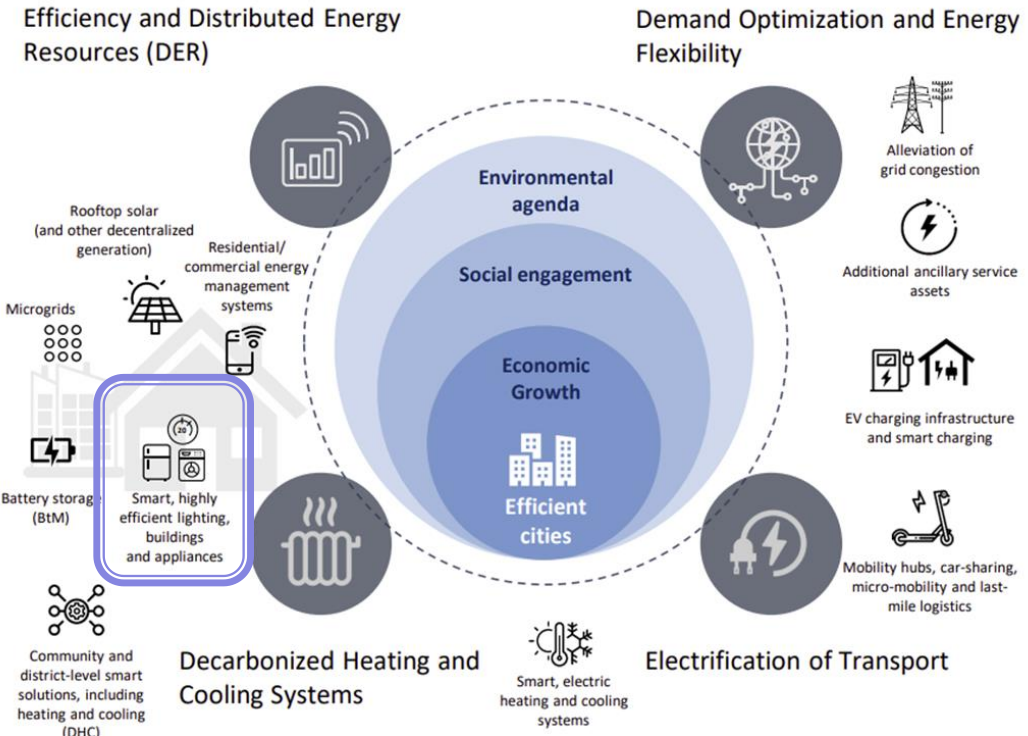


Smart Energy System Buildings in URBAN Energy System



Towards a decentralised, decarbonised and flexible energy system

Greater digitalization and system integration can enable efficient, climate-neutral cities



Urban Energy systems

“integrated urban energy system”

Edifici : micro energy hubs

Connected Cities and Electrification

No Electricity
No Smart City



A Smart Consumer-centric Energy System



SET PLAN 2018 EDITION

What is a smart building?

Smart building means different things to different people

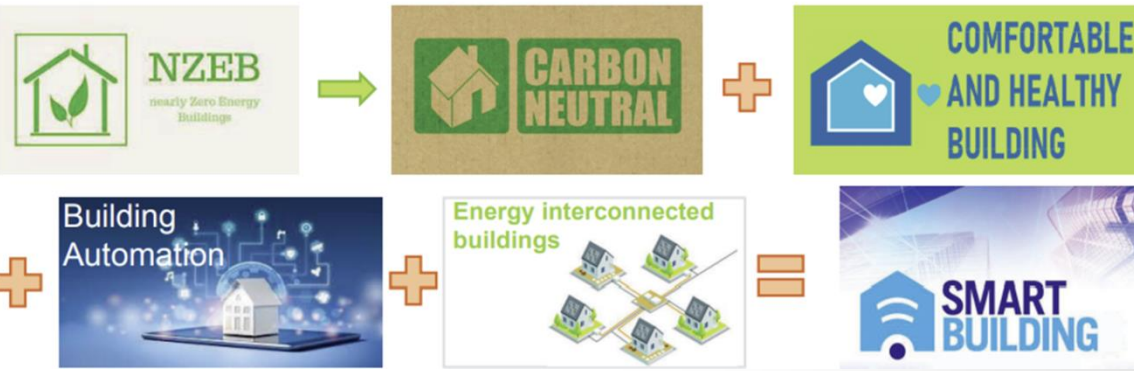
Definizioni, componenti  **sistemi di valutazione**

BPIE definition of a smart building (2017):

Building Performance Institute Europe

“A smart building is highly energy efficient and covers its very low energy demand to a large extent by on-site or district-system-driven renewable energy sources. A smart building

- (i) *stabilises and drives a faster decarbonisation of the energy system through energy storage and demand-side flexibility;*
- (ii) *empowers its users and occupants with control over the energy flows;*
- (iii) *recognises and reacts to users' and occupants' needs in terms of comfort, health, indoor air quality, safety as well as operational requirements.¹⁾”*



Smart Buildings

Norme Tecniche Internazionali, Europee e Nazionali

- Automatic controls
- Energy management
- Cybersecurity
- Infrastructures
- Connectivity
- Digital technologies
- Smart appliances
- Interoperability
- Sustainability



CEN/TC 350 Sustainability of construction works
CEN/TC 247 Controls for mechanical building services



TECHNICAL COMMITTEES

ISO/TC 268

Sustainable cities and communities

ISO/TC 59

Buildings and civil engineering works

ISO/TC 184

Automation systems and integration

ISO/IEC JTC 1/SC 41 Internet of Things and Digital Twin



International
Electrotechnical
Commission

SyC Smart Energy

SyC Smart Cities Electrotechnical aspects of Smart Cities



IEC-ISO-ITU
JOINT SMART CITIES TASK
FORCE

UNI EN ISO 52120-1:2022

CEI TC 13-64-120-205-306-317



SG20: Internet of things (IoT) and smart cities and communities (SC&C)



CENELEC



Commissione UNI/CT 058 Città, comunità e infrastrutture sostenibili

SMART BUILDING in Standards and EU Projects



TECHNICAL COMMITTEES

ISO/TC 268

Sustainable cities and communities

DRAFT INTERNATIONAL STANDARD
ISO/DIS 37173

ISOSmart community infrastructure — Development
guidelines for the information system of smart
buildings

3.3 smart building

building that can **identify** and **adapt** to both expected and not expected **changes by effective use of data, information and communication technology** and to continually **improve prediction and action in response to the various needs of *building values, urban activities and urban operations.***

Smart
Built4EU
The European Building System

January 2023

Smart Buildings
Future
Technologies

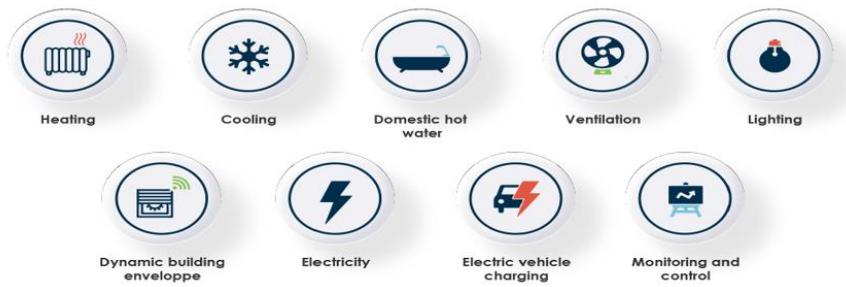


Smartness of a building refers to the ability of a building or its systems to ***sense, interpret, communicate and actively respond*** in an efficient manner to ***changing conditions*** in relation to the operation of ***technical building systems*** or the ***external environment (including energy grids)*** and to ***demands from building occupants.***

SMART Readiness Indicator

EPBD RECAST 2010/31 UE
DIRETTIVA (UE) 2018/844

Capacità di un edificio o di un'unità immobiliare di adattare il proprio funzionamento alle esigenze dell'occupante e della rete e di migliorare l'efficienza energetica e la prestazione complessiva durante l'uso.
(regolamento delegato (UE) 2020/2155 del 14 ottobre 2020)



ONE SINGLE SCORE CLASSIFIES THE BUILDING'S SMART READINESS



Smart-ready services



Evoluzioni del concetto di Smart Building

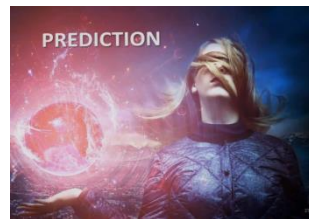
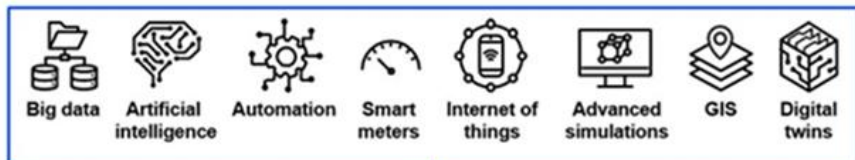
“An intelligent/smart building is one that doesn't make the occupants look stupid.”

Sam C M Hui Technological and Higher Education Institute of Hong Kong ·



- Internet of Things sensors IOT
- Intelligent Building Management System IBEMS
- Artificial intelligence AI
- Augmented reality AR
- 5G

consentono allo Smart Building di controllare e ottimizzare le sue performances automaticamente o come supporto alle decisioni, con interfacce utente per controllarne le operazioni



IEA EBC - Annex 81 - Data-Driven Smart Buildings



- Analytics
 - Prediction
 - Energy Savings Strategies
 - Operational Optimization



Editorial
Special Issue Cognitive Buildings

Lavinia Chiara Tagliabue ^{1,*} and Ibrahim Yitmen ²

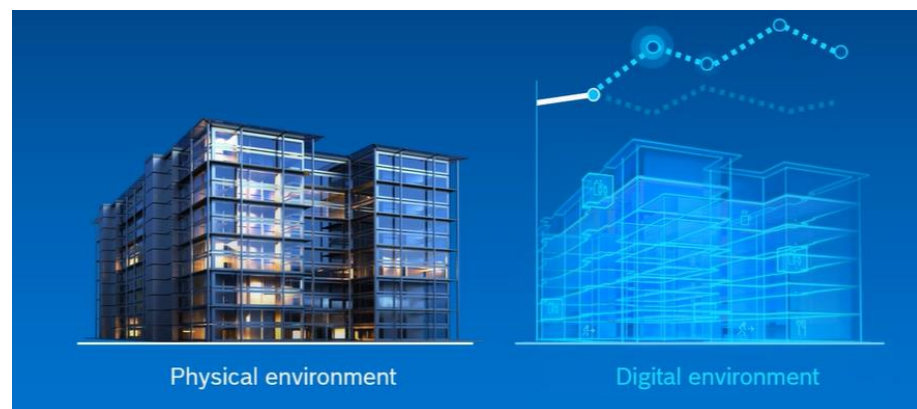
What if? BUILDING Digital Twin

ISO/IEC JTC 1/SC 41

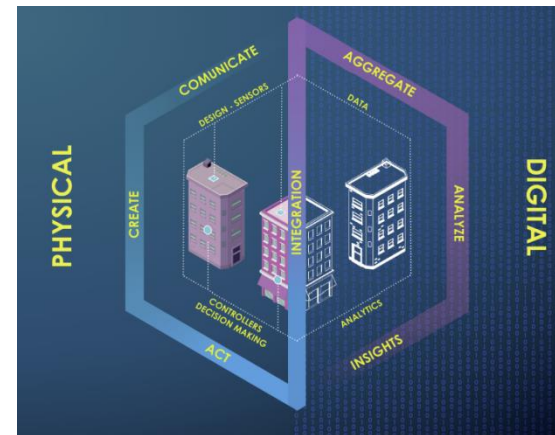
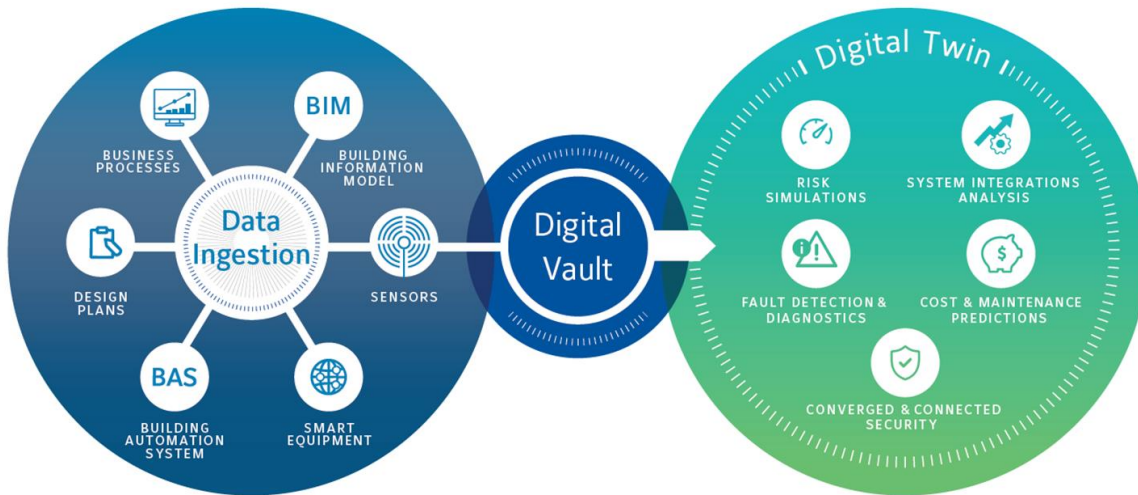
Internet of things and digital twin

ISO/IEC AWI 30173

Digital twin — Concepts and terminology



«modello composto da un asset fisico, un avatar e un interfaccia»
[ISO/TR 24464:2020]



DIGITAL TWIN DEFINITIONS FOR BUILDINGS SPHERE

Buildings as a Service^[1]



Buildings as a Service

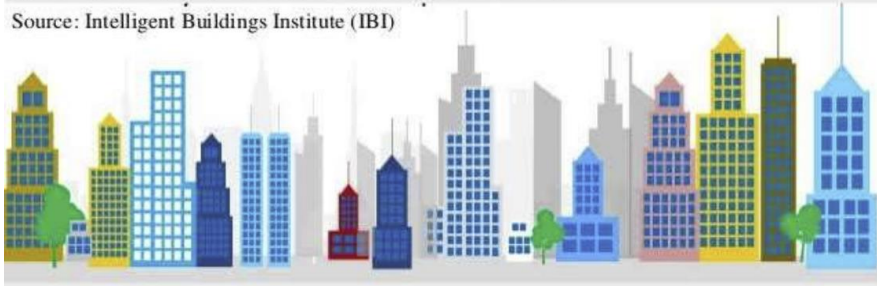
Edificio come **risorsa di servizi generati** per gli users non solo nell'edificio,
Edifici come **piattaforme di informazioni** e servizi personalizzati ai consumatori.



Smart Building:

A building that provides a productive and cost-effective environment through optimization of its four basic components - structure, systems, services and management - and the interrelationships between them."

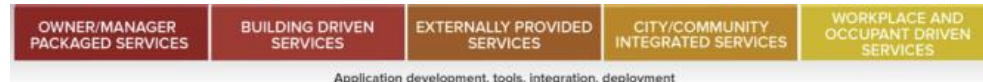
Source: Intelligent Buildings Institute (IBI)



Services

Use the building connectivity and communication capacity to enable deployment of services

ENERGY SERVICES
SERVICES FOR BUILDING
SERVICES FOR OCCUPANTS



Application development, tools, integration, deployment

Sistema informativo di edificio

Smart community infrastructure — Development guidelines for the information system of smart buildings
ISO/DIS 37173



Fig. 1. Ecosystem Components technology of Smart Building

[1] Building-as-a-Service: "Theoretical Foundations and Conceptual Framework". MDPI, Adrian Wildenauer, Alex Mbabu, Jason Underwood, Josef Basl

Contributo degli edifici alla Sostenibilità della Città

HOW SUSTAINABLE BUILDINGS

are #BuildingResilience to climate change and for people and economies

WorldGBC's strategy – Sustainable Buildings for Everyone, Everywhere – supports the Sustainable Development Goals to accelerate an inclusive, resilient and net zero built environment.

GOAL 8: Decent Work and Economic Growth

The construction of sustainable buildings and infrastructure can create jobs, reskill and upskill workers, enabling a just transition to a low-carbon economy.

GOAL 9: Industry, Innovation and Infrastructure

Sustainable buildings and cities provide equitable and high-quality urban and regional infrastructure that promotes economic development, human welfare and cleaner operation as part of a circular economy.

GOAL 12: Responsible Consumption and Production

Sustainable buildings are circular buildings that optimise resource use, result in zero waste to landfill, and support the regeneration of resources and natural systems.

GOAL 3: Good Health and Well-being

Sustainable buildings and cities promote human health by encouraging healthy lifestyles, protecting people from harm across the building and construction lifecycle.

GOAL 6: Clean Water and Sanitation

Sustainable buildings can protect scarce water resources, driving water efficiency and reducing waste, and enhance water quality and sanitation.

GOAL 7: Affordable and Clean Energy

Sustainable buildings provide access to affordable, reliable and clean energy by prioritising energy efficiency and low- or zero-carbon energy sources.

GOAL 10: Reduced Inequalities

Sustainable buildings protect human health and promote a decent standard of living across the lifecycle, from quality employment and human rights for construction and material workers, to eliminating energy poverty and ensuring affordability and comfort in

GOAL 11: Sustainable Cities and Communities

Sustainable cities provide access to high-quality housing and public infrastructure to all citizens, promoting harmonious social, environmental and economic development.

17 PARTNERSHIPS FOR THE GOALS



GOAL 17: Partnerships for the Goals

Sustainable buildings and cities are created through powerful partnerships that enhance knowledge sharing and ambition across the three pillars of sustainability – planet, people and economies.

GOAL 7: Affordable and Clean Energy

Sustainable buildings provide access to affordable, reliable and clean energy by prioritising energy efficiency and low- or zero-carbon energy sources.

GOAL 13: Climate Action

Considering the importance of the longevity of buildings, sustainable buildings support clean energy used efficiently, and sustainable cities work alongside individual buildings to decarbonise public resources and infrastructure, and incorporate future-proofing mechanisms to improve resilience and adaptation to future climatic change.

GOAL 15: Life on Land

Sustainable buildings provide access to nature for everyone and enable nature-based solutions that enhance resilience and support biodiversity and ecosystem services.



WORLD GREEN BUILDING COUNCIL

SUSTAINABLE DEVELOPMENT GOALS

The holistic concept of Building's Sustainability



JRC SCIENCE FOR POLICY REPORT

Promoting healthy and highly energy performing buildings in the European Union

National implementation of related requirements of the Energy Performance Buildings Directive (2010/31/EU)

Stylianos Kephelopoulos, Otmar Geiss, Josefa Barrero-Moreno, Della D'Agostino, Daniele Paci

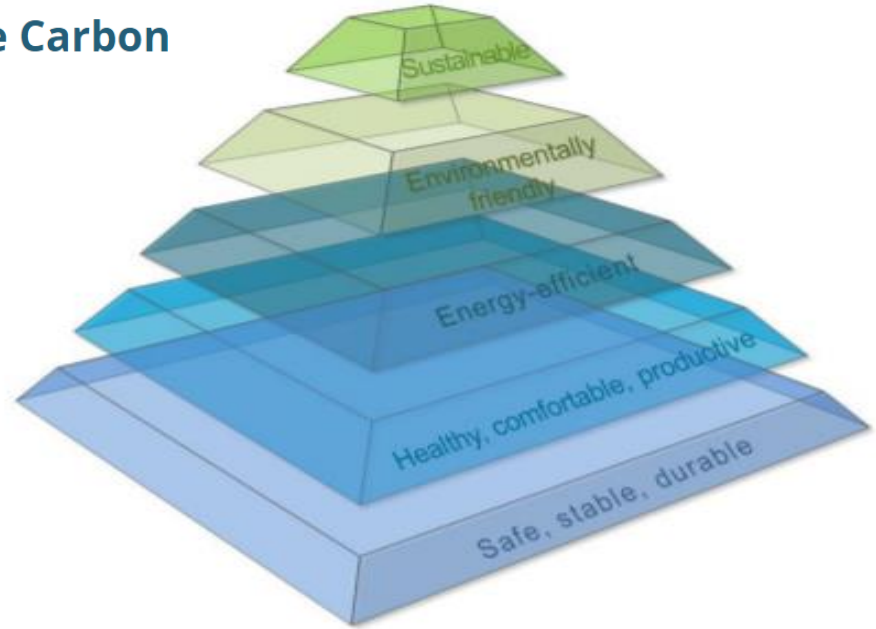
2017



EUR 27665 EN



Whole-life Carbon



@porto university

Ventilation, IAQ, pollution sources, health and rational use of energy: a challenging interplay

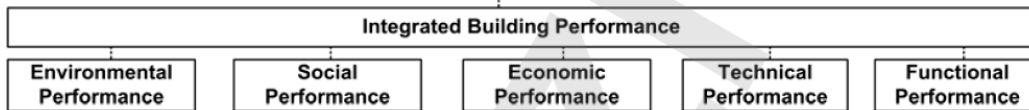
Nuovi approcci: gli edifici nella Città Sostenibile



ISO 15392:2019

Sustainability in buildings and civil engineering works —
General principles

Gli edifici sono sostenibili quando consentono le prestazioni richieste e la funzionalità con minimo impatto sull'ambiente, **promuovendo il miglioramento negli aspetti economici, socio-culturali, ambientali a livello locale, regionale, globale.**



ISO 21931-1:2022 Sustainability in buildings and civil engineering works — Framework for methods of assessment of the environmental, social and economic performance of construction works as a basis for sustainability assessment — Part 1: Buildings

UNI EN 15643:2021 “Sostenibilità delle costruzioni – Quadro di riferimento per la valutazione degli edifici e delle opere di ingegneria civile“.



Contents lists available at SciVerse ScienceDirect

Sustainable Cities and Society

journal homepage: www.elsevier.com/locate/scs

Clarifying the new interpretations of the concept of sustainable building
Umberto Berardi*

IN A CLIMATE-NEUTRAL EUROPE, BUILDINGS WILL BE...

Salute e benessere



**HEALTHY
AND FOSTER WELL-BEING**

People will live, work and study in buildings with thermal comfort in all seasons, good air quality, sufficient access to daylight and very low noise levels.

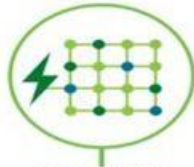


**CIRCULAR
IN MATERIALS
AND USE**

Material circularity should be the norm. Buildings should also adapt to occupants' changing needs and allow for a variety of uses over time.

Sostenibilita'

Flessibilita'



**PART OF THE
ENERGY SYSTEM
INFRASTRUCTURE**

Buildings will interact with the power and heat networks.



**FOSSIL FUELS
FREE**

Renewable energy will cover the low energy needs of the building sector.

Decarbonizzazione

**Efficienza
energetica**



**ENERGICALLY
EFFICIENT**

Buildings will have very low energy consumption and no energy is wasted.



**RESILIENT
TO CLIMATE RISK**

Buildings must be resilient and adapted to impacts caused by a changing climate.

Resilienza

Proposta di DIRETTIVA DEL PARLAMENTO EUROPEO E DEL CONSIGLIO sulla prestazione energetica nell'edilizia (rifusione), 14 marzo 2023

"edificio a emissioni zero": edificio ad altissima prestazione energetica, che contribuisce all'ottimizzazione del sistema energetico attraverso la flessibilita' della domanda, nel quale qualsiasi fabbisogno residuo molto basso di energia e' interamente coperto da:

- fonti rinnovabili generate o stoccate in loco
- fonti rinnovabili generate nelle vicinanze non in loco e fornite attraverso la rete
- una comunita' di energia rinnovabile
- energia rinnovabile e calore di scarto provenienti da un sistema efficiente di teleriscaldamento e teleraffrescamento

da silos indipendenti a sistemi integrati e interoperabili

Approccio Olistico agli edifici nel ciclo di vita

Efficienza energetica

Sostenibilita'

Smartness

Bellezza

Resilienza

Salute, comfort, benessere

Adattivita' alla rete e agli utenti

Naturalità

Circolarita'

Zero emissioni

Qualita'



BUILDING



Positive Energy Districts and neighbourhoods transforming urban energy system



*smart energy communities
Virtual Power Plants*

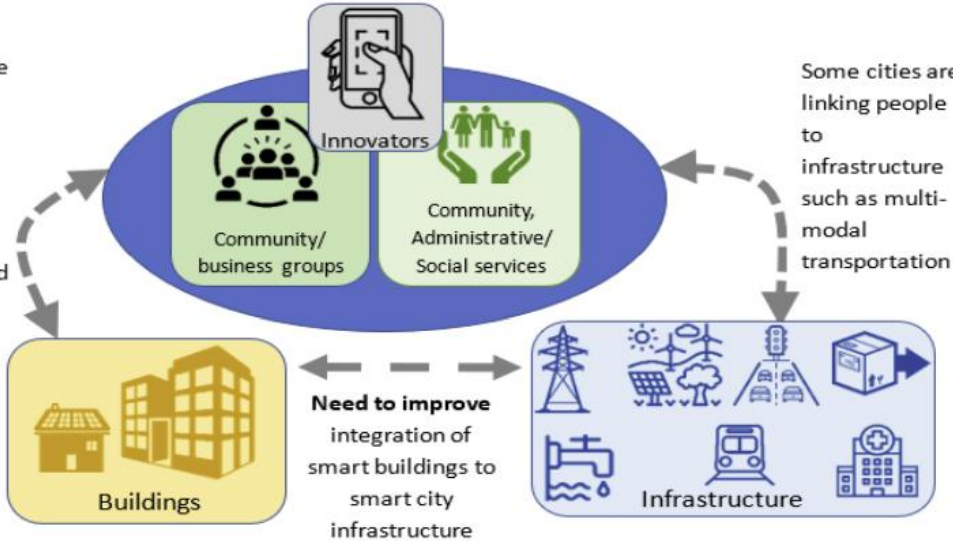


Progetto di norma: «il contributo degli edifici alla sostenibilità
Approccio metodologico di riferimento e valutazione

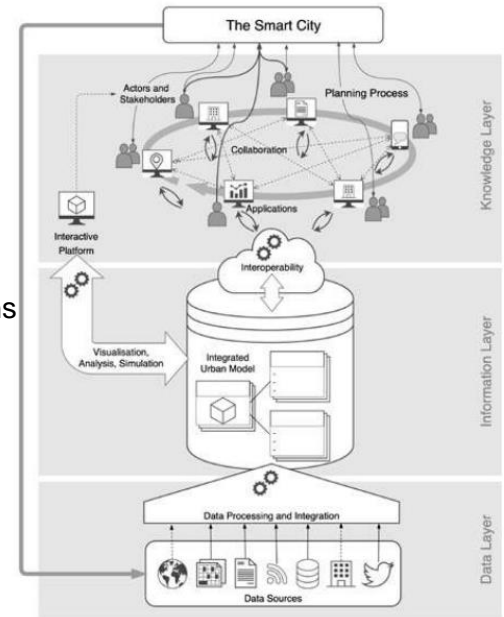
Building2Building Buildign2Grid Buildings2City

Current "smart cities" are being driven primarily by people's use of technology.

Smart Buildings are currently focused on meeting occupants' needs for comfort, wellness and productivity



City information modelling and urban digital twins



Conceptual Framework for City Information Modelling



City digital twin

Smart Buildings: a foundation for safe, healthy & resilient cities - NIST Global Cities Team Challenge (GTC) Smart Buildings Supercluster 2020



Dati, energia, servizi, valore per la Città

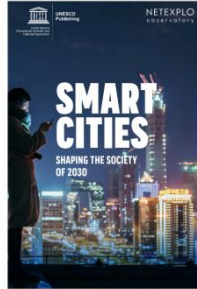
smart city is as a distributed, open *mesh network* of connected smart buildings

Smart Resilient Sustainable City



A TECHNO-CENTRIC CITY

Digital, A.I., IoT, cloud computing, pervasive mobile networks, big data systems, urban platform, city digital twin , C.I.M.



Smart technologies
Smart infrastructures
Cyber Physical System

Approccio integrato e olistico

Data driven City, la valorizzazione dei dati

ADAPTIVE SENSEABLE EFFICIENT Cities



Rio de Janeiro Centre of Operations, 2010

Sustainable City



ISO/TC 268

Sustainable cities and communities



CEN/TC 465 - Sustainable Cities and Communities



Commissione UNI/CT 058 Città, comunità e infrastrutture sostenibili



SUSTAINABLE DEVELOPMENT GOALS
17 GOALS TO TRANSFORM OUR WORLD



Grazie