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#EU GREEN WEEK

EU Green Week Partner Event

Examining the Water-Energy-Food nexus at the buildings Using Environmental Performance Assessment Methods

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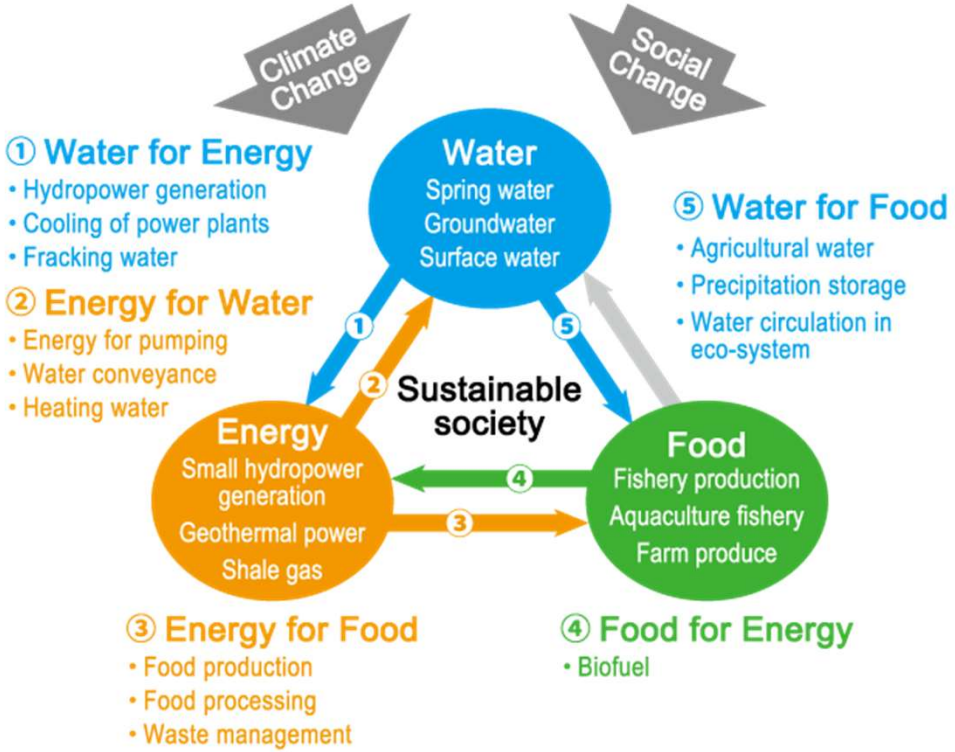
THE WATER-ENERGY-FOOD NEXUS: BUILDING RESILIENCE TO GLOBAL CHALLENGES

NexusNet

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

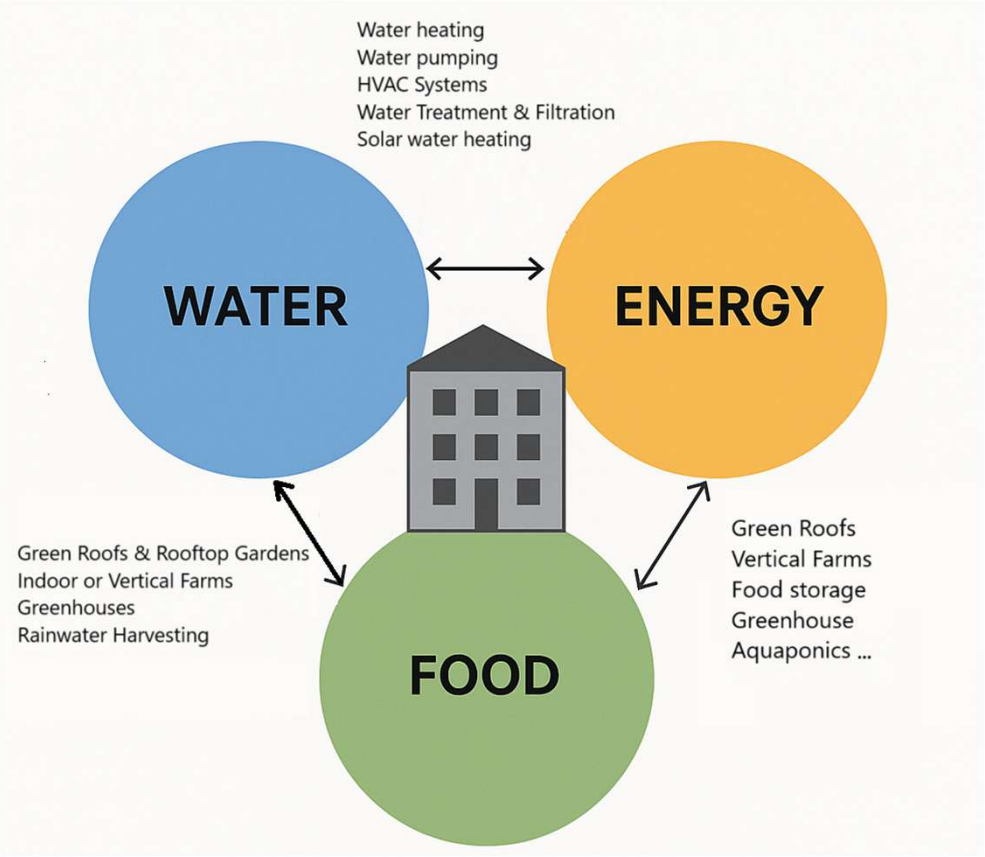
WEF Nexus at Macro scale (national, regional)



Usually applied at the Macro scale
Increasingly relevant at the building scale

Self-sustain buildings

Why WEF Nexus at the building scale?



- **Helps address energy and water demands directly where they're used most**
- **Tools like green roofs, façades, urban farming, On-site energy and water systems (building as a mini-ecosystem)**
- **Reducing pressure on national infrastructure and supporting urban sustainability**

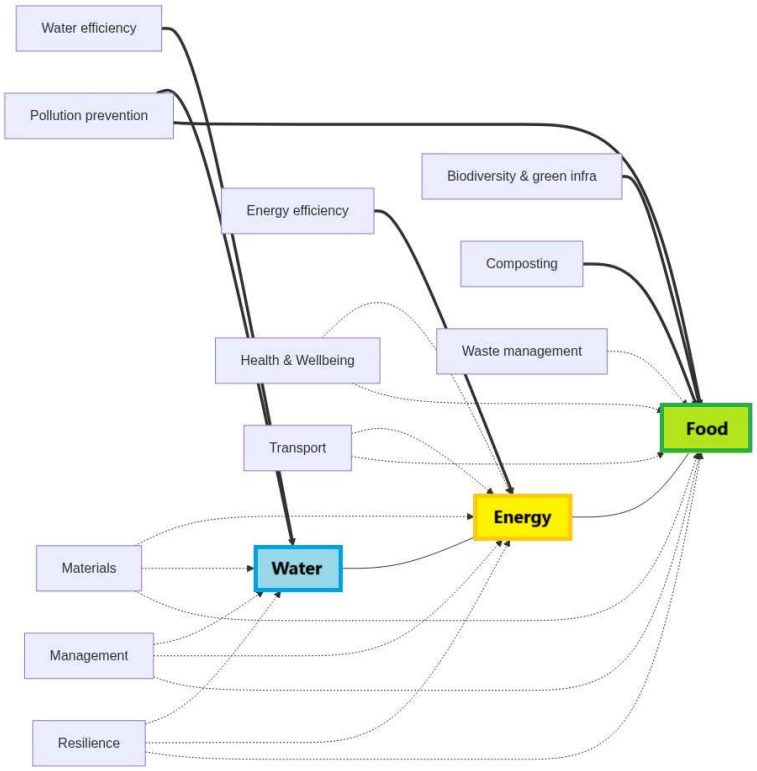
Research Aim & Method:

How do current Building Sustainability Assessment Tools align, cover, and support the WEF Nexus?

BREEAM	**Building Research Establishment Environmental Assessment** Method BREEAM International New Construction 2021 Version 6.0
DGNB	**German Sustainable Building Council (Deutsche Gesellschaft für Nachhaltiges Bauen)** DGNB System for new buildings version 2020- International
LEED	**Leadership in Energy and Environmental Design** LEED for Building Design and Construction (LEED BD+C), New Construction and Major Renovations Version 4.1, 2023
SBTool	**Sustainable Buildings Tool** SBTool for Buildings 2022 A
Level(s)	**EU Sustainable Buildings Framework** Most recent consolidated version (2021–2022)

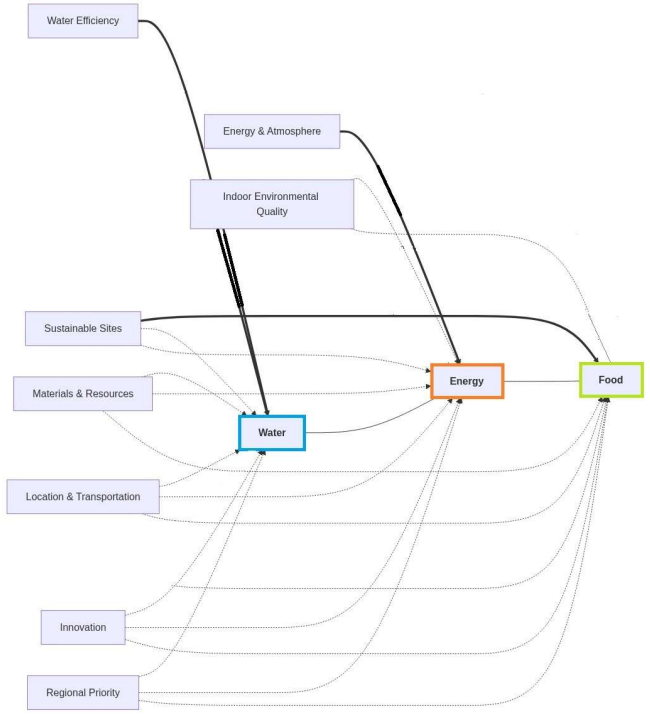
Alignment matrix based on SD 243 BREEAM In-Use International: Residential Technical Manual (V6.0.0) for a residential building

Category	Criterion	W	E	F	Explanation
Energy	Energy efficiency (systems, lighting, etc)	-	●	-	Reduces energy demand and emissions.
	Renewable/low-carbon energy use	-	●	-	Promotes clean energy, reduces carbon footprint.
Water	Water use monitoring & efficiency	●	-	-	Reduces water consumption and supports water security.
	Leak detection and prevention	●	-	-	Prevents water loss and associated damage.
	Water-efficient appliances/fittings	●	-	-	Lowers water demand in the building.
Pollution	Pollution prevention (air, water, noise)	●	○	○	Protects water/soil for food, reduces energy for treatment, safeguards food production.
	Stormwater management	●	-	○	Reduces runoff, supports urban agriculture.
Land Use & Ecology	**Biodiversity & green infrastructure**	○	-	○	Enables urban agriculture, supports food systems, enhances water retention.
Waste	Composting facilities	-	-	○	Supports food waste recycling and local food production.
	Waste management (recycling, reduction)	-	○	○	Reduces landfill, supports circular food systems, saves embedded energy.
Materials	Sustainable material sourcing	○	○	○	Reduces resource competition and pollution, supports food safety.
Health & Wellbeing	Indoor air quality	-	○	○	Supports occupant health and food preparation safety.
	Daylighting and views	-	○	-	Encourages healthy lifestyles, supports food-related wellbeing.
	Access to outdoor space	-	-	○	Enables gardening, community food growing, and healthy eating.
Management	Building management & occupant engagement	○	○	○	Enables integrated WEF management, supports food-related community action.
Transport	Transport (public, cycling, EV)	-	○	○	Supports local food supply chains, reduces energy for transport.
Resilience	Resilience (climate, emergency)	○	○	○	Improves building response to WEF-related shocks (drought, heat, supply disruption).



Alignment matrix based on LEED and WEF nexus

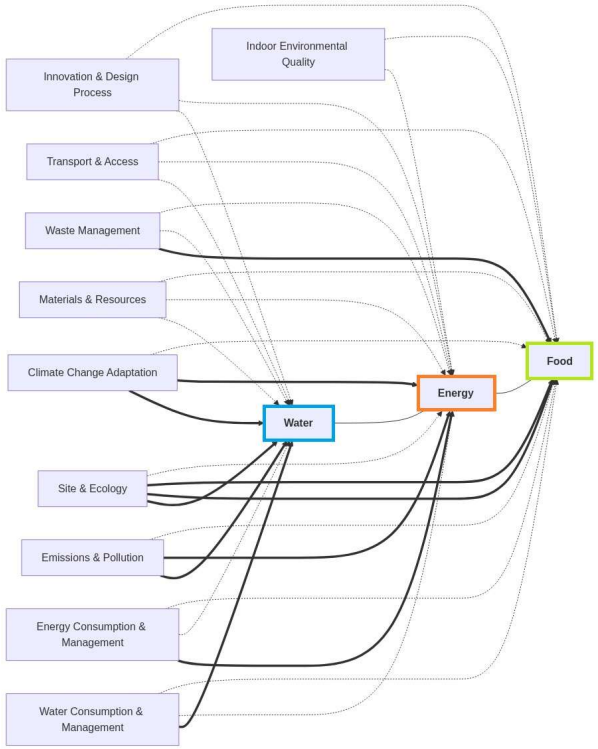
LEED Category / Credit	W	E	F	Explanation of Association
Water Efficiency	●	-	-	Directly reduces potable water use through efficient fixtures, irrigation, and water reuse.
Energy & Atmosphere	-	●	-	Directly targets energy efficiency, renewable energy, and energy management.
Sustainable Sites	○	○	○	Site design reduces runoff (water), vegetation/orientation can reduce energy demand, and supports urban agriculture/community gardens (food).
Materials & Resources	○	○	○	Sustainable sourcing and recycling reduce water/energy use in production and support food systems via composting and packaging reduction.
Location & Transportation	○	○	○	Compact development may reduce water demand, reduces transportation energy, and improves access to local food.
Innovation	○	○	○	Can introduce innovative solutions for water, energy, or food, depending on project focus.
Regional Priority	○	○	○	May address local water, energy, or food issues depending on regional context.



Nexus Link	Explicit Mention	Indirect Reference	LEED Categories Involved
Water–Energy	-	moderate	Water Efficiency, Energy and Atmosphere
Energy–Food	-	-	Sustainable Sites, Innovation
Water–Food	-	-	Water Efficiency, Sustainable Sites

Alignment matrix based on SBTools and WEF nexus

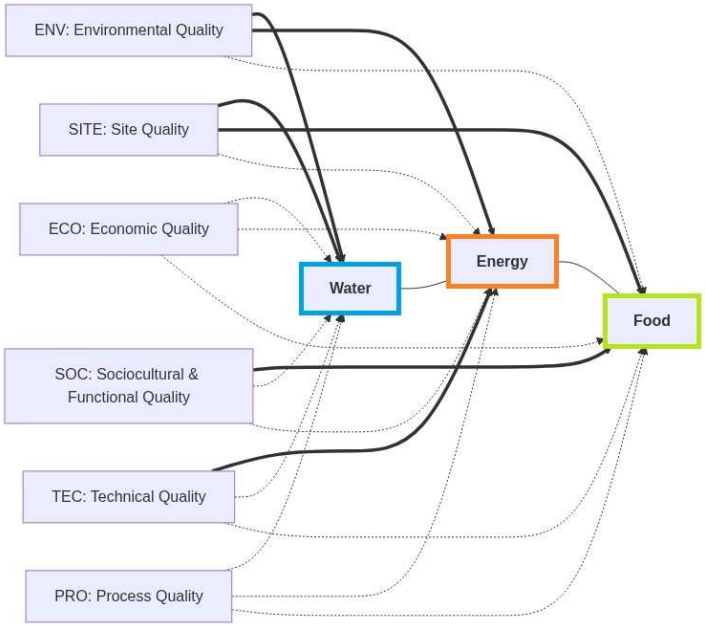
SBTool Category / Credit	W	E	F	Explanation of Association
Water Consumption & Management	●	○	○	Directly targets water savings and efficient use; indirectly reduces energy for water supply/treatment and may support food production via irrigation efficiency.
Energy Consumption & Management	○	●	○	Directly targets energy efficiency and renewables; indirectly reduces water use for energy (cooling, generation) and energy for food processing.
Site & Ecology	●	○	○	Directly supports water (natural hydrology), food (urban agriculture, biodiversity), and indirectly energy (microclimate, shading).
Materials & Resources	○	○	○	Sustainable sourcing and recycling reduce water/energy use in production and support food systems via composting and packaging reduction.
Indoor Environmental Quality	-	○	○	Ventilation, daylighting, and thermal comfort can reduce energy demand (indirect), and healthy indoor spaces support food preparation/consumption.
Transport & Access	○	○	○	Compact development may reduce water demand, reduces transportation energy, and improves access to local food.
Waste Management	○	○	○	Recycling and composting reduce energy/water use (indirect) and directly support food systems by managing organic waste.
Emissions & Pollution	●	●	○	Pollution controls protect water and food systems directly, and reduce energy-related emissions.
Innovation & Design Process	○	○	○	Can introduce innovative solutions for water, energy, or food, depending on project focus.
Climate Change Adaptation	●	●	○	Directly addresses resilience in water and energy systems, and may indirectly support food security.



WEF Nexus Link	Explicit Mention	Indirect Reference	SBTool Categories Involved
Water–Energy	-	**moderate**	Water Use, Energy Systems, HVAC
Energy–Food	-	Very Limited	indirectly by referring to Land Use
Water–Food	-	Indirect and limited	Site Development, Water Reuse
Systems Thinking	-	high	Resource Efficiency, Custom Adaptations

Alignment matrix based on DGNB and WEF nexus

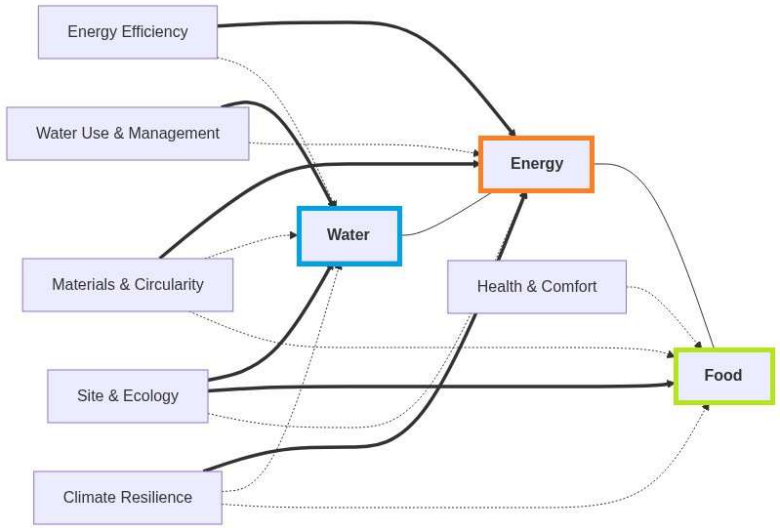
DGNB Category / Credit	W	E	F	Explanation of Association
ENV: Environmental Quality	●	●	○	Directly addresses water (use, pollution, ecology) and energy (efficiency, renewables); may support food via biodiversity, soil, and green infrastructure.
ECO: Economic Quality	○	○	○	Indirectly supports all pillars by promoting resource efficiency and life-cycle cost savings that can incentivize sustainable water, energy, and food solutions.
SOC: Sociocultural & Functional Quality	○	○	○	Indirectly supports water and energy via user comfort and health; directly supports food through urban agriculture, healthy food environments, and community spaces.
TEC: Technical Quality	○	●	○	Directly supports energy via building systems and controls; indirectly supports water and food through efficient technical solutions (e.g., smart irrigation, refrigeration).
PRO: Process Quality	○	○	○	Indirectly supports all pillars by encouraging integrated planning, stakeholder engagement, and innovation, which can enhance water, energy, and food outcomes.
SITE: Site Quality	●	○	○	Directly supports water (hydrology, stormwater), food (urban agriculture, biodiversity), and indirectly energy (microclimate, passive design).



WEF Nexus Element	Explicit Mention	Indirect Reference	DGNB Criteria/Areas Involved
Water–Energy	-	Strong	Environmental Quality, LCA
Water–Food /Land	-	Moderate	Site Quality, Ecological Quality
Energy–Food	-	Weak	Optional, context-dependent
Systems Thinking	Not called "nexus"	High	Integrated design, circularity, resilience

Alignment matrix based on Level(s) and WEF nexus

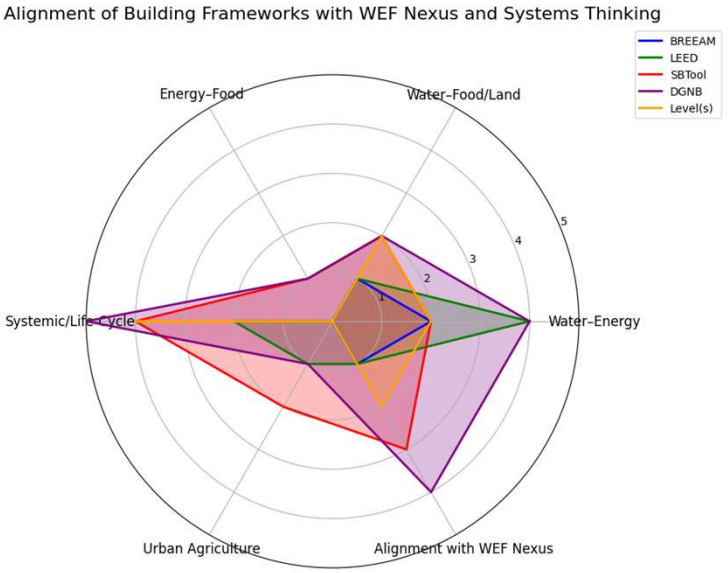
Category / Credit	W	E	F	Explanation of Association
Water Use & Management	●	○	-	Directly addresses water consumption reduction and efficient management. Indirectly reduces energy for water treatment/distribution.
Energy Efficiency	○	●	-	Directly targets energy performance and renewables. Indirectly reduces water use in energy production (e.g., cooling).
Materials & Circularity	○	○	○	Sustainable materials reduce water/energy use in production and support food systems via compostable packaging/waste reduction.
Health & Comfort	-	-	○	Indoor environmental quality indirectly supports food preparation/storage areas.
Climate Resilience	●	○	○	Directly enhances energy system resilience; indirectly protects water/food systems from climate impacts.
Site & Ecology	●	○	○	Directly supports water (stormwater management) and food (urban agriculture/biodiversity); indirectly supports energy via microclimate design.



WEF Nexus Element	Explicit Mention	Reference	Level(s) indicator Involved
Water–Energy	-	Indirectly	Life cycle Global Warming Potential. -Use stage energy performance. On-site renewable energy. -Drinking water consumption Use of non-potable water
Water–Food /Land	-	-	
Energy–Food	-	-	
Systems Thinking	Partially: LCA perspective resource flows , but not full systems thinking or WEF interlinkages		-Building life cycle assessment. -Global warming potential -Resource use, water, energy -Design for adaptability and renovation -Design for deconstruction, reuse, and recycling

Comparative Matrix of WEF Nexus Alignment in Sustainability Rating Tools

Feature	BREEAM	LEED	SBTool	DGNB	Level(s)
Explicit Mention of WEF Nexus	-	-	-	-	-
Water–Energy	Medium level	**high**	Medium	**high**	Moderate
Water–Food / Water–Land	**Weak**	**Weak**	Moderate (thru land use & irrigation)	Moderate (thru land use, green roofs)	Moderate
Energy–Food	-	-	Weak (optional, contextual)	Weak (contextual, via site use)	-
Systemic / Life-Cycle Thinking	Moderate	Moderate (via Integrative Process)	**Strong** (customizable LCA/LCC)	**Very Strong** (core principle)	**Strong** (through LCA, LCC, circularity principles)
Urban Agriculture / Food Systems	Weak	Weak (through inovaton category	Possible thtough customization	Indirectly supports (site quality)	-
Alignment with WEF Nexus Approach	Indirect, limited	Indirect, limited	**Medium**	**high**	Medium



Findings

Water	• All tools include criteria for **water efficiency**, **rainwater harvesting**, and **greywater reuse**. • All promote technologies and design strategies that **reduce water demand** and **improve water management**.
Energy	• Focus: **energy-efficient design**, **renewables**, and **low-carbon technologies**. • Encourage **energy modeling** and **lifecycle analysis** to optimize consumption.
Food	• Direct food-related criteria are minimal. • **SBTool** offers optional credits for **urban agriculture** and **local food access**. • **DGNB** and **BREEAM** address **land use** and **biodiversity.**
Systems Thinking / Nexus Alignment	• They promote **integrated design**, **lifecycle assessment**, and **resource efficiency**, in line with WEF Nexus goals, especially **SBTool** and **Level(s)**
Trade-off analysis	• **Cross-resource synergies** are not deeply considered. • **DGNB** and **SBTool** has the most potential and alignment.

Conclusion and Recommendations

- Inclusion of Nexus-focused indicators
- Integrating circularity principles can enhance the future version of these assessment tools

Thank You For Your Attention!

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