B4B: Brains4Buildings WP4
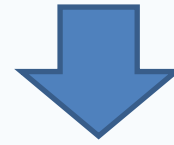# Smart Building Assessment Extended Summary

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B4B – WP4 Data Integration

B4B project adds operational intelligence to buildings in order to achieve a transition towards energy-efficient and flexible buildings. One of its primary ambition is
"**Standardized Smart Readiness Indicator (SRI) and quick-scan**"

Deliverable 4.4:   Smart Building Assessment (**Deerns**)

1. Smart Building Assessment Extended Summary
2. Smart Building Assessment Excel Sheet (e-mail dev@deerns.com to receive it)
3. Smart Building Assessment User Manual (e-mail dev@deerns.com to receive it)

Smart Building Assessment
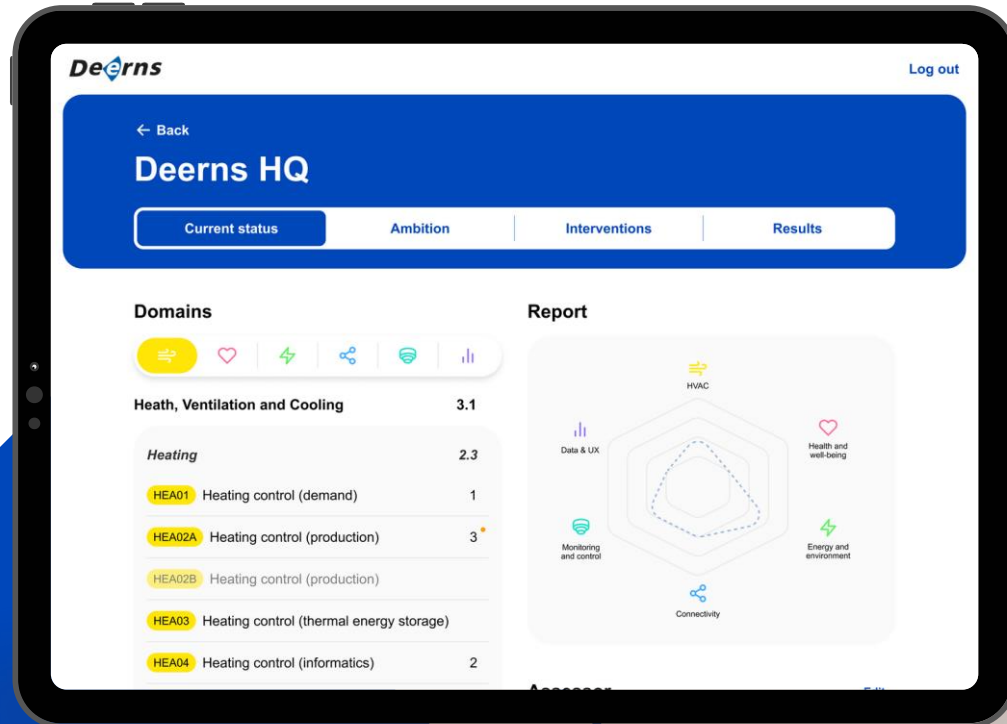
Your journey towards a smarter building starts here

The transition to smart buildings and cities requires new solutions that only smart environments can enable. Take the first step by assessing your building/portfolio based on a holistic approach and map and budget your ambition for the future.

Smart Building Assessment in short

Composed of four layers

1. Assessment on each domain
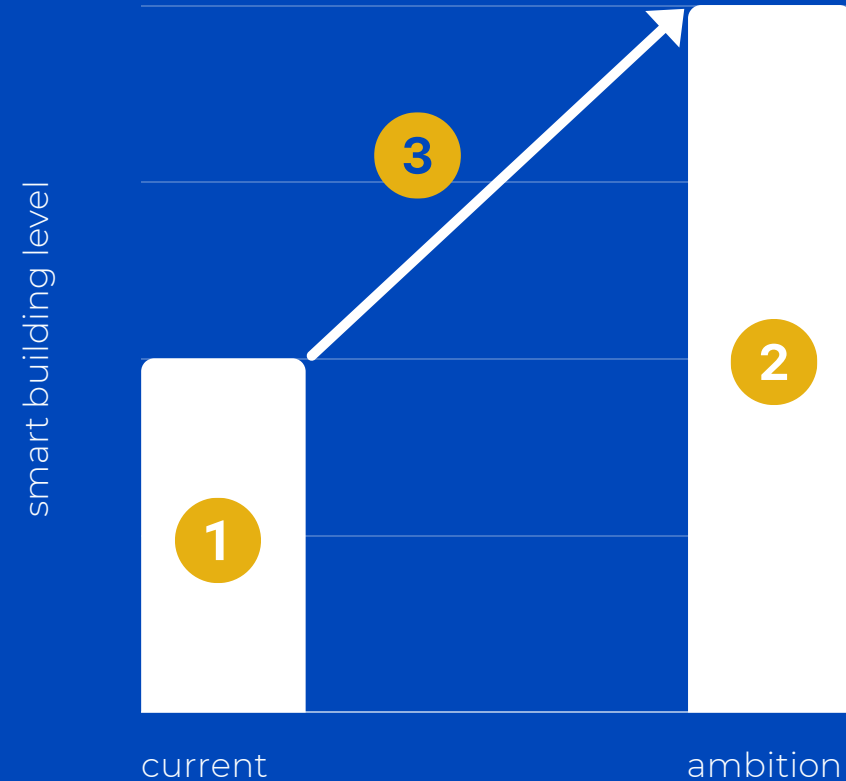Assess the current level of each domain

2. Define Ambition
Define the ambition for each domain

3. Gap Analysis & Building Upgrade Plan
Define the gap between current and desired level & the interventions to reach the desired level

4. Cost Analysis
Investment needed for the interventions

smart building level

current   ambition

Smart Building Assessment in short

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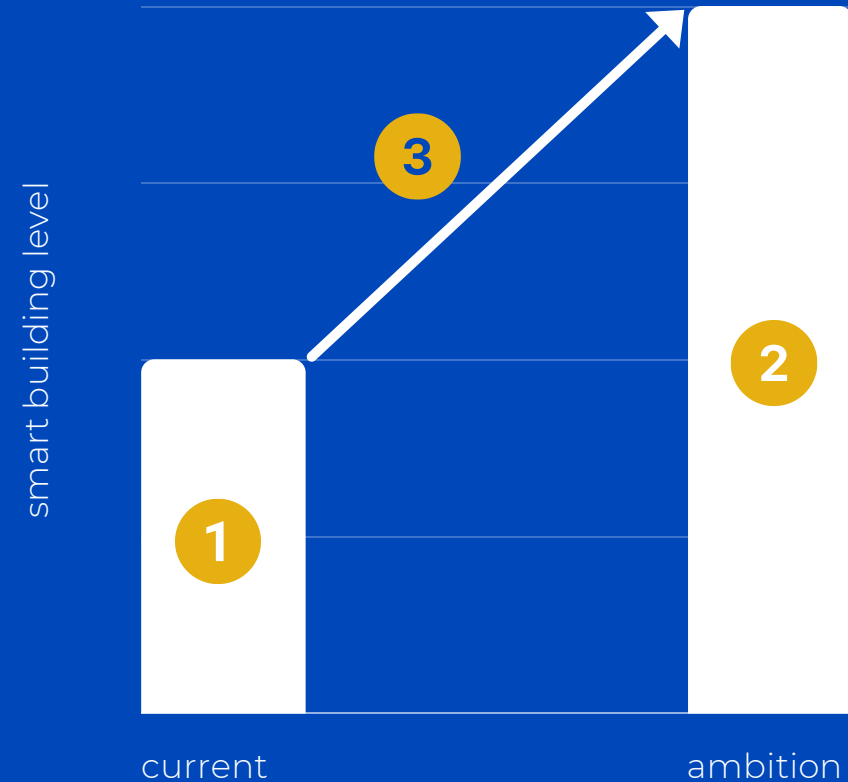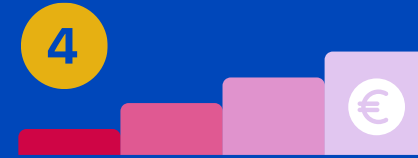Assess the current level of each domain

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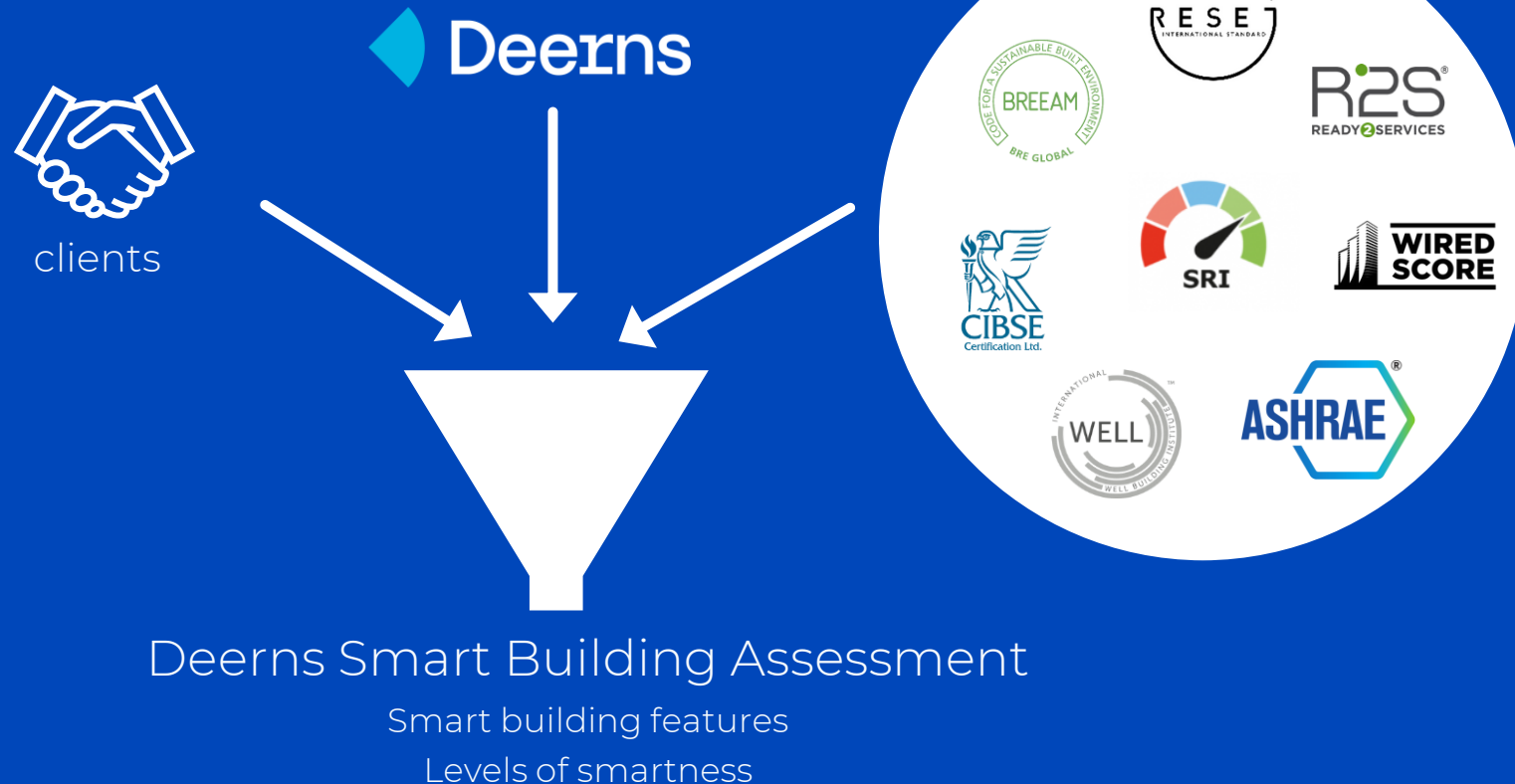**4. Cost Analysis**
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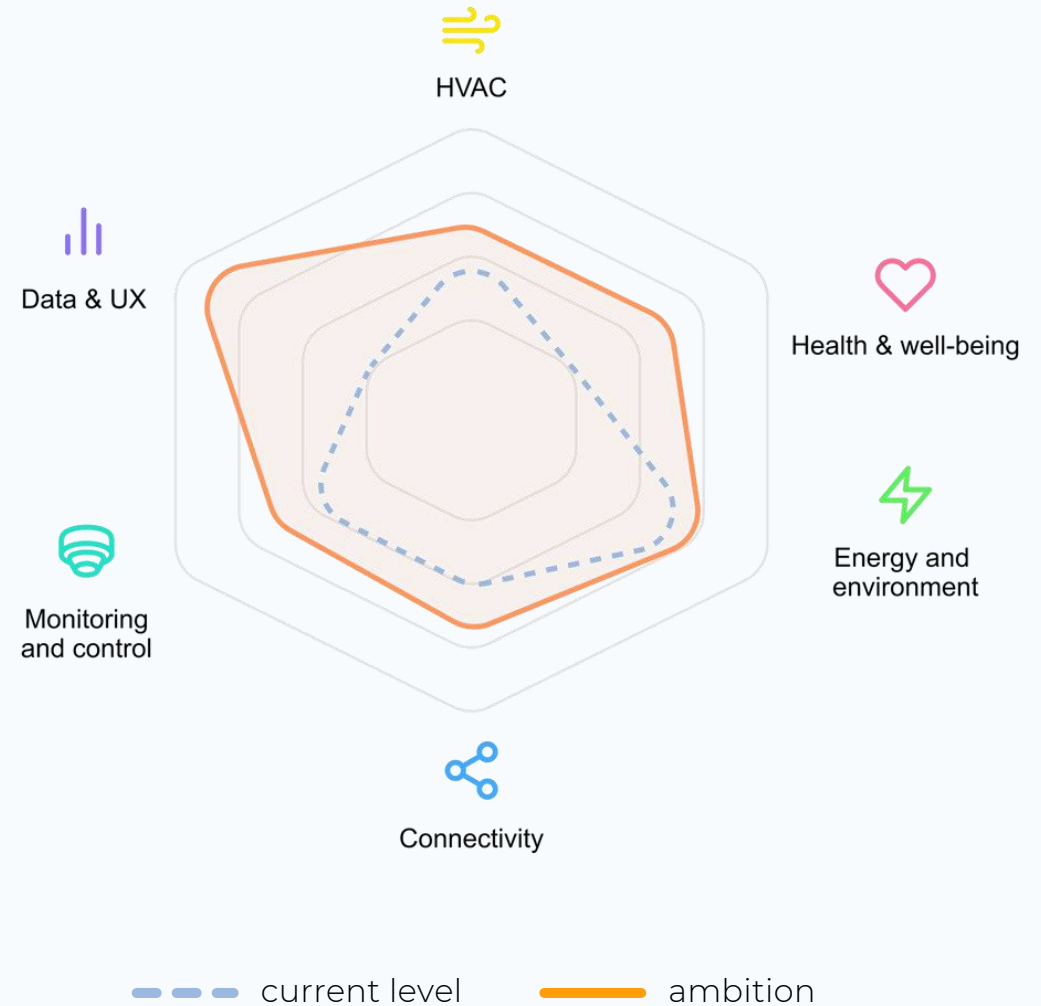current   ambition

SMART BUILDING ASSESSMENT

Smart building Assessment

6 Domains

78 check items

HVAC

Health & well-being

Energy and environment

Connectivity

Monitoring and control

Data & UX

- - - current level   —— ambition

Methodology break-down
Smart Building Assessment Sheet

Energy & Environment

Item ID	Domain	Feature	Response (Level)	Options / Levels					Notes/remarks	Sources
				Level 0	Level 1	Level 2	Level 3	Level 4		
LIG01	Lighting	Lighting (control)		Manual on/off switch	Automated controls with standard schedule	Manual on/off switch + additional sweeping extinction signal	Automatic detection (auto/dimmed on or off)	Automatic dimming including scene-based light control	Always to be assessed	SRI
LIG03	Lighting	Lighting (informatics)		No reporting of status present	Status of lighting appliances per room	Status of lighting appliances per island	Level 2 and measurement of illuminance	Level 3 with historical information	Always to be assessed	Deerns
ELE01	Electricity	Electricity (storage)		Not present	On site storage of electricity (e.g. batteries or thermal storage)	On site storage of energy (e.g. electric battery or thermal storage) with controller optimising for 1 function in the list	On site storage of energy (e.g. electric battery or thermal storage) with controller optimising for 2 functions in the list	On site storage of energy (e.g. electric battery or thermal storage) with controller optimising the for 3 functions in the list	Only applicable in case of local energy generation. Optimization functions - promoting self consumption, Grid balancing, Profit (variable energy pricing)	SRI
ELE02	Electricity	Electricity (storage reporting)		Not present	Current state of charge (SOC) data available	Actual values and historical data	Performance evaluation including forecasting and/or benchmarking	Performance evaluation including forecasting and/or benchmarking; also including predictive management and fault detection	Only applicable in case of local energy generation	SRI
ELE03	Electricity	Electricity (renewable reporting)		Not present	Current generation data available	Actual values and historical data	Performance evaluation including forecasting and/or benchmarking	Performance evaluation including forecasting and/or benchmarking; also including predictive management and fault detection	Only applicable in case of local energy generation	SRI

Methodology break-down
Smart Building Assessment Sheet

Energy & Environment

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ELE01	Electricity									SRI
ELE02	Electricity									SRI
ELE03	Electricity	Electricity (renewable reporting)		Not present	Current generation data available	Actual values and historical data	Performance evaluation including forecasting and/or benchmarking	including forecasting and/or benchmarking; also including predictive management and fault detection / Only applicable in case of local energy generation		SRI

LIG01 – Lighting (control)

The threshold for rooms with lighting control is set to at least 50%.

A sweeping extinction signal is a signal sent out for example at the end of the day to turn off all lighting.

Benefits:

1. Energy savings: Advanced lighting control enables energy saving by turning off lights after office hours or turning off lights when no people are detected. Average electricity savings for different strategies are: presence-based lighting (24%), dimmable lighting(36%) and daylight harvesting(28%). Reference : LBNL best estimates of average lighting energy savings for various control strategies based on a review of 240 energy savings estimates published in 88 papers and case studies. Source: Lawrence Berkeley National Laboratory, 2011.

2. Comfort: User experience can be improved by providing options such as scene based lighting according to the type of space.

*The methodology and the benefits of all the check items are available in the **Smart Building Assessment User Manual**

Remarks

Heating, cooling, ventilation, DHW mainly on how the HVAC components are controlled based on SRI and Deerns input

Sensors, informatics, placement, control on indoor air quality, comfort, natural light based on RESET, SRI, Deerns input, BREEAM

Lighting, electricity, optimization, energy storage, EV charging, flexibility, metering based on SRI, Deerns input, BREEAM

IoT, connections, network supply & coverage based on WiredScore, SmartScore, Deerns input and R2S

Control & safety smart grid, smoke detection, emergency etc. based on Deerns input and SRI
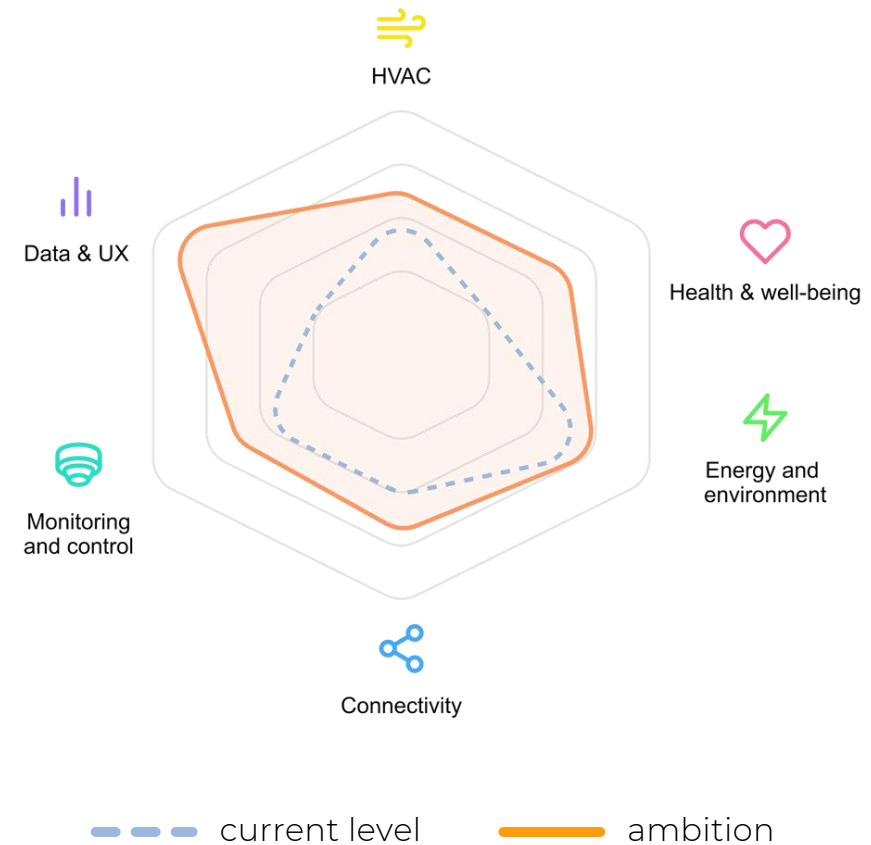
Occupancy analytics, data pipeline, user experience etc based on Deerns input

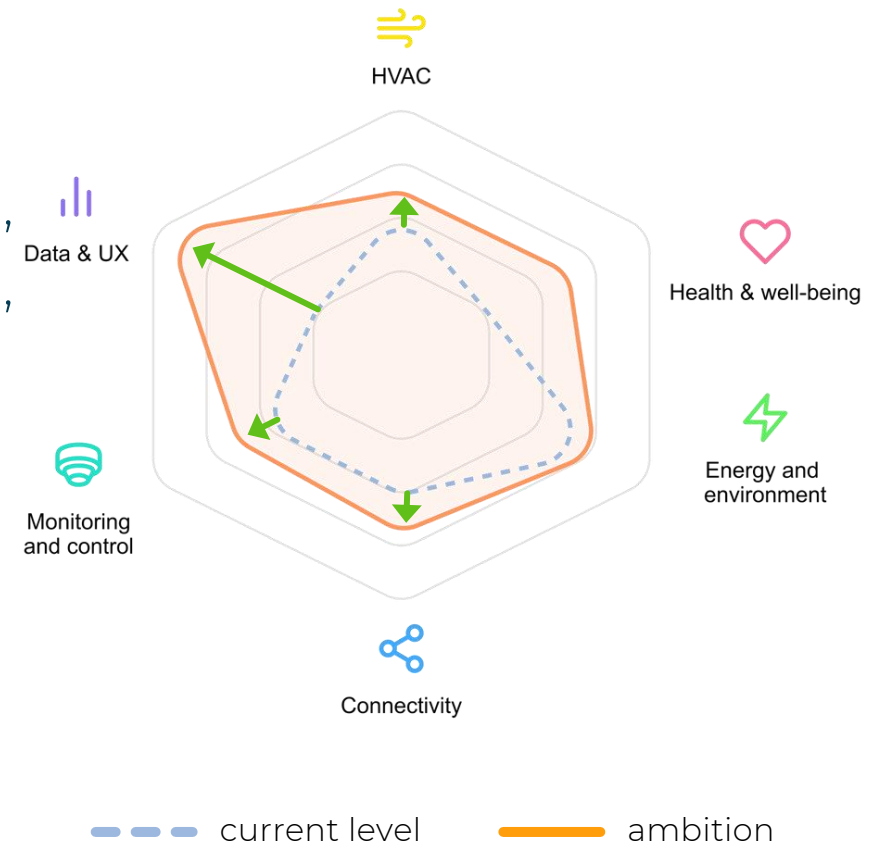# SMART BUILDING UPGRADE PLAN

Smart Building Upgrade Plan

- Once the ambition is understood, a smart building upgrade plan is prepared

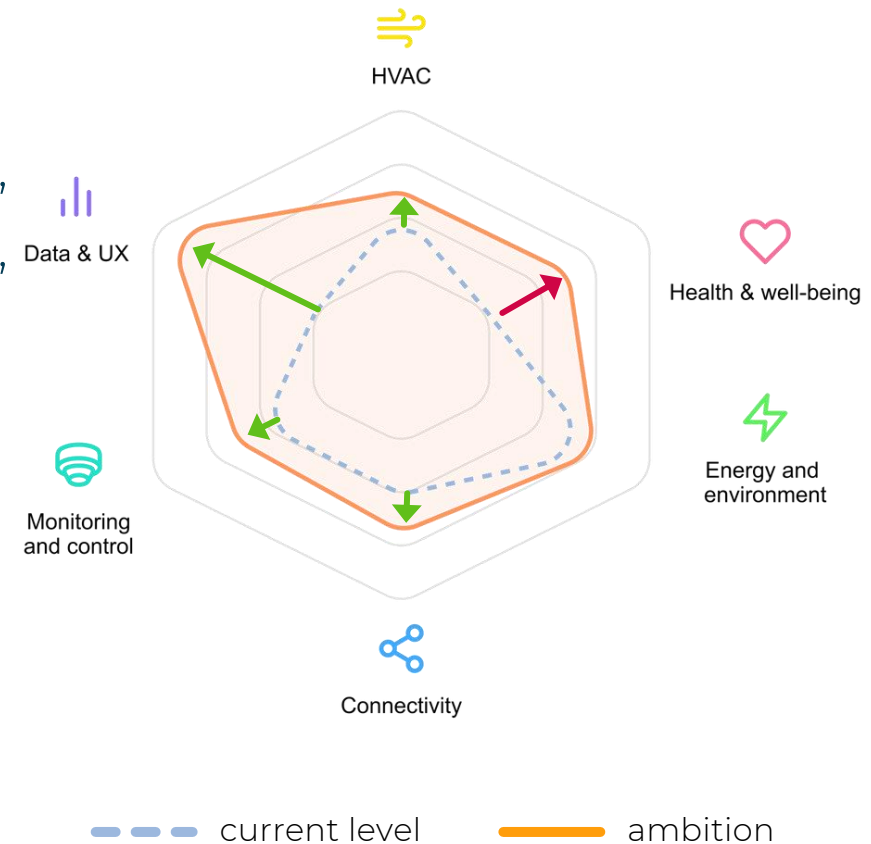# Smart Building Upgrade Plan

- Once the ambition is understood, a smart building upgrade plan is prepared
  - BMS Upgrade ->
    - HEA02, HEA03, COO02, COO03, VEN03, CTR02, MON01, DAT01, DAT03 …

HVAC

Data & UX

Health & well-being

Energy and environment

Monitoring and control

Connectivity

- - - current level ——— ambition

Smart Building Upgrade Plan

- Once the ambition is understood, a smart building upgrade plan is prepared
  - BMS Upgrade ->
    - HEA02, HEA03, COO02, COO03, VEN03, CTR02, MON01, DAT01, DAT03 ...
  - New air quality monitoring ->
    - -IAQ01, IAQ02, IAQ03, COM01...

HVAC

Data & UX

Health & well-being

Energy and environment

Monitoring and control

Connectivity

- - - current level   ———— ambition

Application of
SMART BUILDING ASSESSMENT as Deerns DDD

Sample Assessment

Domain	Current status	Budget specific	Maximum achievable
⇒ HVAC	0.5	1.1	1.1
♡ Health & Wellbeing	0.5	1.8	1.8
⚡ Energy & Environment	0.8	1.6	1.8
🛜 Monitoring & Control	2.0	2.0	2.3
⌁ Connectivity	0.1	1.0	1.1
⊪ Data & UX	0.6	1.1	1.7

Current status	Assessment score - based on the building documents
Budget Specific	
Maximum Achievable	Scenario assessment score - based on building owner ambitions

Sample Assessment

		Current status		Budget specific		Maximum achievable	
IAQ01	Monitoring (sensors)	1	CO2 sensors only	3	CO2 and VOC sensors	3	CO2 and VOC sensors
IAQ02	Monitoring (outdoor sensors for air intake)	0	Not present	4	1 sensor per air intake, all with CO2 and PM2.5 capability	4	1 sensor per air intake, all with CO2 and PM2.5 capability
IAQ03	Monitoring (placement and density)	1	Sensors only in common areas or meeting rooms	3	Sensors in all of the rooms that are mostly used	3	Sensors in all of the rooms that are mostly used
USE01	Access control	2	RFID based	2	RFID based	3	mobile based
USE02	Access control system	1	On-premises system	1	On-premises system	1	On-premises system
USE03	Indoor positioning	0	Not present	0	Not present	0	Not present
USE04	Digital signage	0	Not present	0	Not present	2	Dynamic digital signage with content management system

Sample Assessment - Interventions

Interventions for budget specific scenario

INT3 - Installing thermostats in all rooms

INT13 - Install submetering sensors for HVAC

INT19 - Installing air quality sensors(CO_2,VOC,PM2.5)

INT30 - Installing outdoor air quality sensors per intake

INT49 - Install energy storage system (batteries)

INT70 - Install gas meter per equipment

INT72 - Install water meter per tenant

INT110 - Install IoT backbone infrastructure

INT143 - Install people-counting sensors in common areas

INT146 - Add advanced BMS software

INT147 - Integrate BIM with equipment in 3D drawings

INT177 - Blinds/shades reporting software/add-on

INT202 - data communication via an API

Interventions for maximum achievable scenario

INT3 - Installing thermostats in all rooms

INT6 - Add occupancy sensor + software in all rooms

INT13 - Install submetering sensors for HVAC

INT19 - Installing air quality sensors(CO_2,VOC,PM2.5)

INT30 - Installing outdoor air quality sensors per intake

INT48 - Combination of INT46 and INT47

INT49 - Install energy storage system (batteries)

INT70 - Install gas meter per equipment

INT72 - Install water meter per tenant

INT104 - Install vertical traffic sensor

INT110 - Install IoT backbone infrastructure

INT125 - Install mobile operator coverage routers

INT143 - Install people-counting sensors in common areas

INT146 - Add advanced BMS software

INT147 - Integrate BIM with equipment in 3D drawings

INT150 - Add access control mobile app

INT156 - Install digital screens

INT157 - Add digital screens software

INT162 - Add parking app

INT177 - Blinds/shades reporting software/add-on

INT201 - Add building app(room reservation, catering and ticketing capability)

INT202 - data communication via an API

Feedback and Actions

User Experience
Philips
Nico Mutsaers

- **Company**: Philips Medical Systems Nederland B.V., largest Healthcare Manufacturing site
- **Job title**: Energy Coordinator
- **Current status of smart buildings within the company**: few sensors, not interactive (reactive), setpoints, EnMS
- **Reason for using SBA**: make buildings react and interact seamlessly with users, health & wellbeing, while reducing energy consumption (campus is 51 years old)

- **Domains which are useful/valuable**: offices: health & wellbeing; assembly: keep to SLA, predictive
- **Domains which are not clear/difficult to explain internally/externally**: data security (incl. network, AVG), why
- **Reasons for lack of clarity** : difficult to relate to end goal, investment needed, benefits, much technical background needed
- **Requirements for the tool when the assessment is implemented as a complete tool**? Lots of simplification, playbook where domains/technical terms are clarified

- **Use cases for the SBA** ? Buildings (offices) where we are working on energy transition, phase out natural gas (fossil fuel)
- **Which kind of buildings would you apply the SBA to** ? Offices with energy label A or better
- **Summary of results obtained from the Assessment:** As of yet only a document to discuss what we want (see: experience).
- **Experience with using SBA**: input for discussion with Philips Real Estate (budget), Facility Manager (on site), future aims clarified (ongoing process)

User Experience
Heijmans
Stelloo Joppe

- **Company**: Heijmans (responsible for the hard services (maintenance) of 280 customers – ASML, Schiphol, RVB, PostNL, Aegon etc.)
- **Job title:** Manager Product Development & Innovation
- **Current status of smart buildings within the company**: Trying te become the orchestrator of why and how a smart building can be valuable for our customers to realize the goals our customers want to achieve
- **Reason for using SBA**: Trying to find the right 'tool' to start the right conversation with our customers

- **Domains which are useful/valuable**: Health & Wellbeing, because that is a relevant topic for our customers.
- **Domains which are not clear/difficult to explain internally/externally**: Data & UX because it is hard for our customers to relate to that topic.
- **Reasons for lack of clarity**: to technical/ to difficult to understand
- **Requirements for the tool when the assessment is implemented as a complete tool**? It must be clear what the results mean. What does a score of 2,6 means (good/bad) and how does the score relate to

- **Use cases for the SBA ?** It would be useful if the tool could be used as a starting point for the right Asset management view – you want to accomplish something and 'we' an tell you if your building is 'smart enough' to realize your objectives
- **Which kind of buildings would you apply the SBA to** ? Any building if the relation between the SBA-score can relate to the goals of our customer
- **Summary of results obtained from the Assessment**: Very technical, very difficult to answer but most of all, what does the result tells you?
- **Experience with using SBA:** With the right adjustments it could be extremely useful for starting the right conversation.

Actions following feedback

1. **Listed the benefits** in terms of energy savings, comfort, cost savings(non energy related) and flexibility for the assessment question in the Smart Building Assessment User Manual.

2. **Reviewed the assessment questions** and made them to be easy to understand. Further enable better communication of the benefits of each assessment question.

3. **Included an interventions list** which need to be applied to achieve the required smartness level. This will give an indication of the investment needed when the prices for each technology is linked. This is available in the Smart Building Assessment Sheet

Future update

1. Include the latest wireless IoT networks in the assessment.

2. Update to include newer technologies. And develop methodology to deprecate old assessment questions or smartness levels. This needs to be done while keeping old assessment scores valid or comparable with new scores after the update.

Comparison with EU SRI

1. **IT and IoT infrastructure** is critical for a smart building of today. There needs to be focus and inclusion of this domain. Including the IT and IoT infrastructure assessment questions in the SRI would add a valuable layer of assessment to the SRI, providing a more comprehensive evaluation of the building's smart capabilities and readiness to integrate new services and technologies.

2. **Data and User experience** assessment questions are recommended as they help meet the expectations of occupants of the building. Incorporating data technologies and user/occupant experience technologies into the SRI would enhance the building's ability to assess its performance and provide actionable insights for building owners and operators.

3. **Tenant focused questions** such as space management tools, water submetering, gas submetering, are recommended to bring the users of the building onboard for achieving the full efficiency of a smart building. By improving transparency, sustainability, occupant satisfaction, accountability, and financial performance, these technologies can help to drive the adoption of smart building technologies and promote sustainable building practices.