INDUSTRIAL SUMMIT 2024
POWERING YOUR SUSTAINABLE INNOVATION

# ST KNX Solutions Empower Smart Living

Ya Wei BAI & Roger LI

# Agenda

1 Imagine Your Smart Living

2 STKNX For Energy Management System

3 STKNX Scheme And Case Sharing

4 Q&A

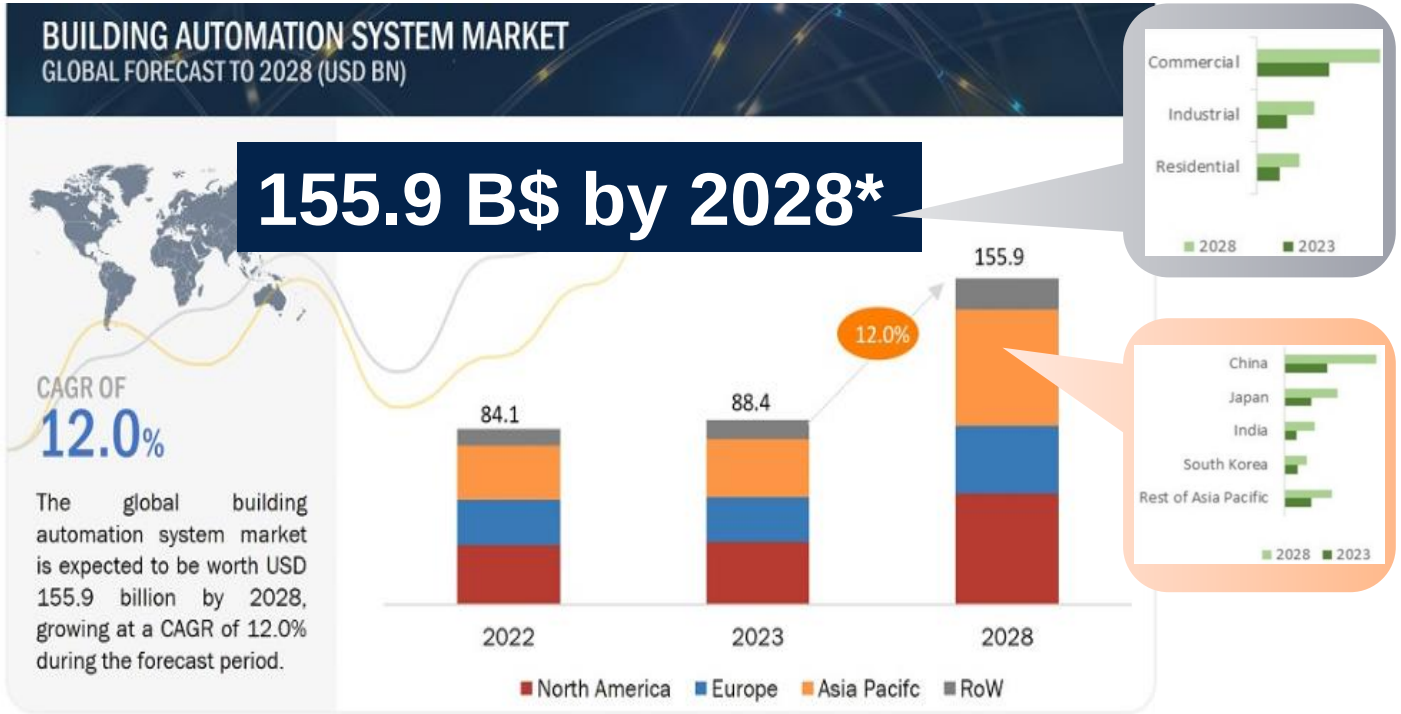
life.augmented

# Imagine Your Smart Living

life.augmented

# Smart Homes Buildings Market

**The energy management segment dominated in 2020 and is projected to remain the fastest-growing segment**




Energy management

Lighting control

HVAC

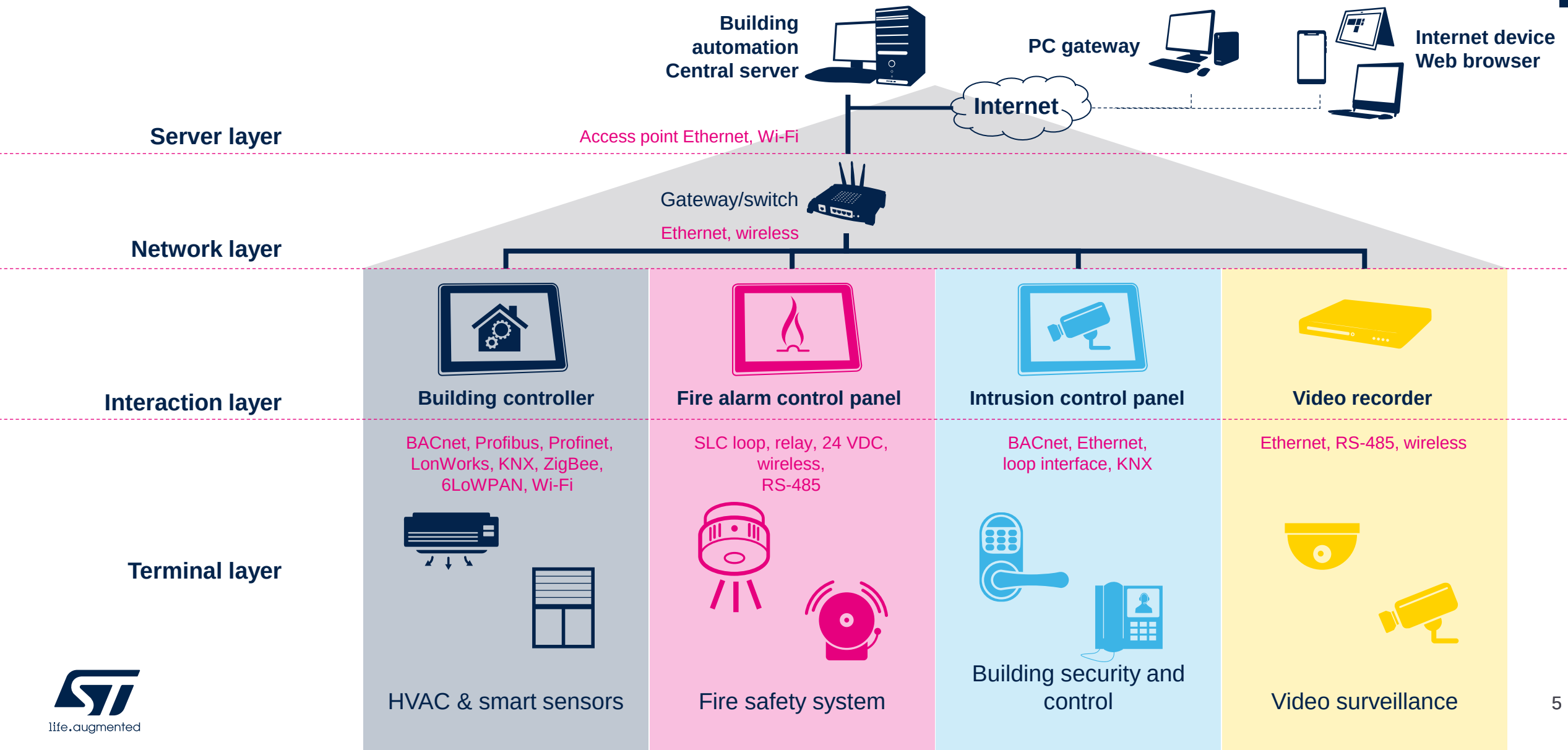
Safety & security

Home healthcare

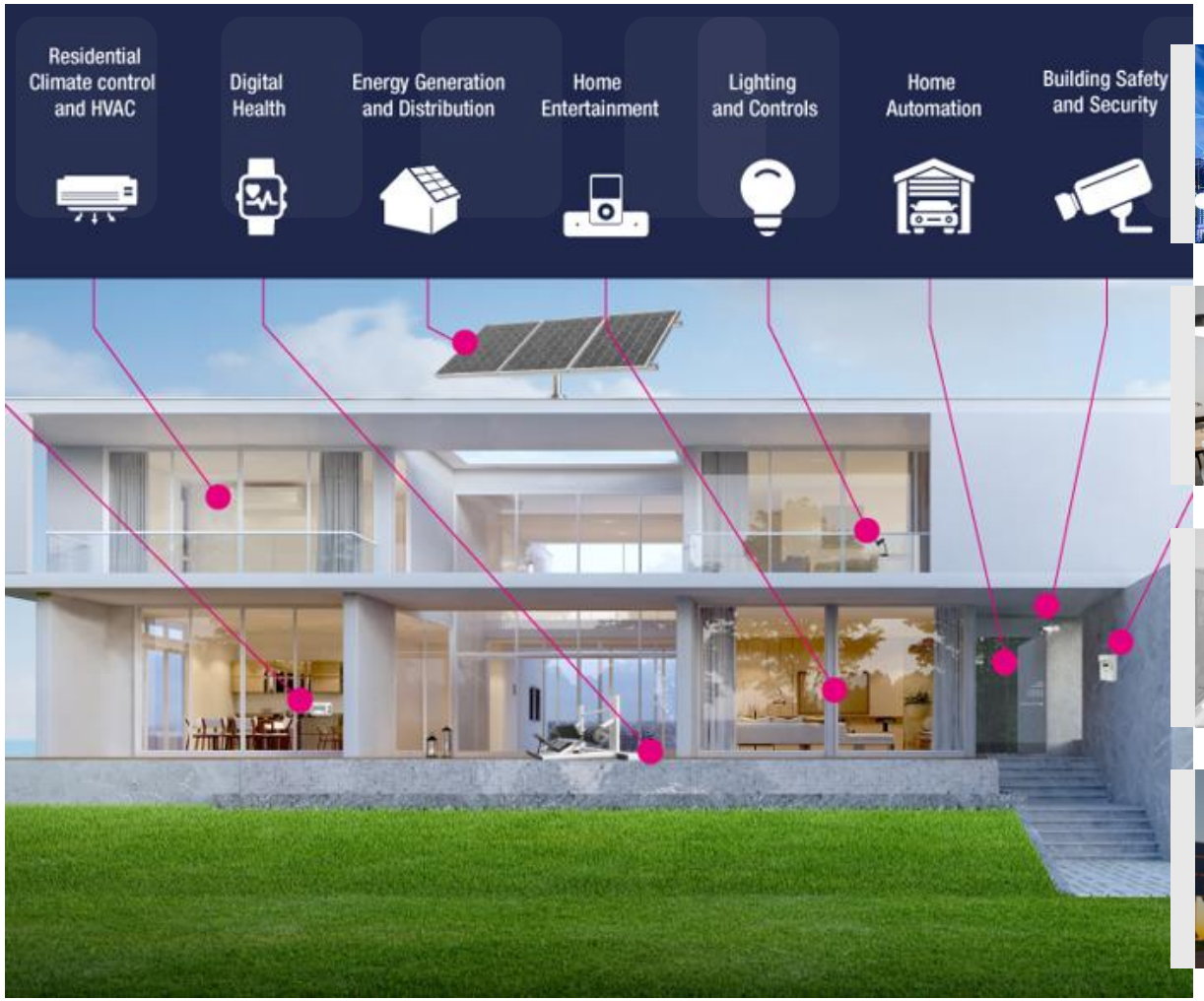
Child safety

Source: https://www.alliedmarketresearch.com/smart-home-automated-building-market

# Home & Building Automation Overview



# Top Smart Home And Building Elements




**Connectivity**

**MCU/MPU control**

**Sensing & monitoring**

**Sustainable power**

KNX

matter

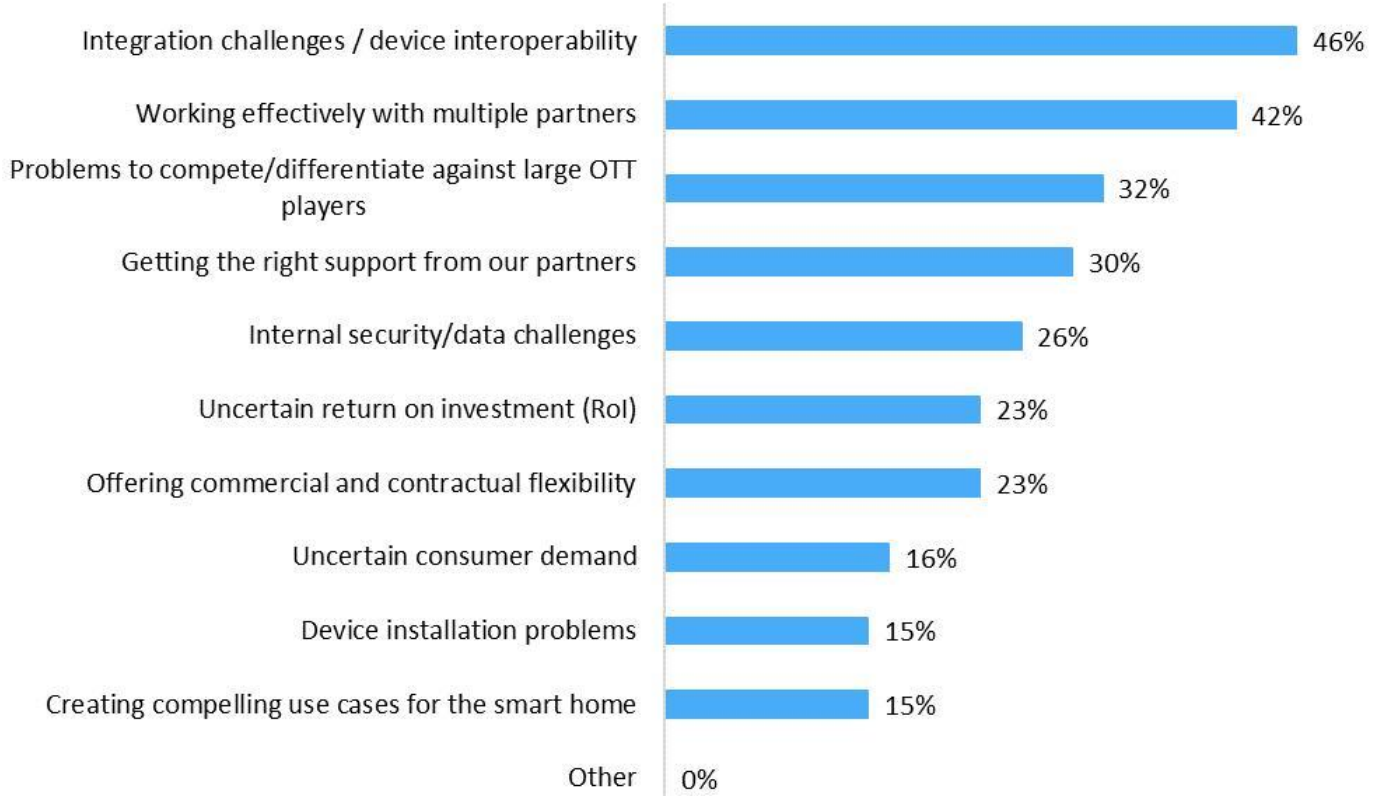
LoRa

sigfox

life.augmented

# Addressing Smart Home Integration And Interoperability

**Q: What are your company's biggest internal challenges in providing smart home services?**




KNX

| Inter-operability | Standard | All applications | High quality |
|---|---|---|---|

| Inter-operability | Easy to use | Security | Reliability |
|---|---|---|---|

matter

Source: Omidia



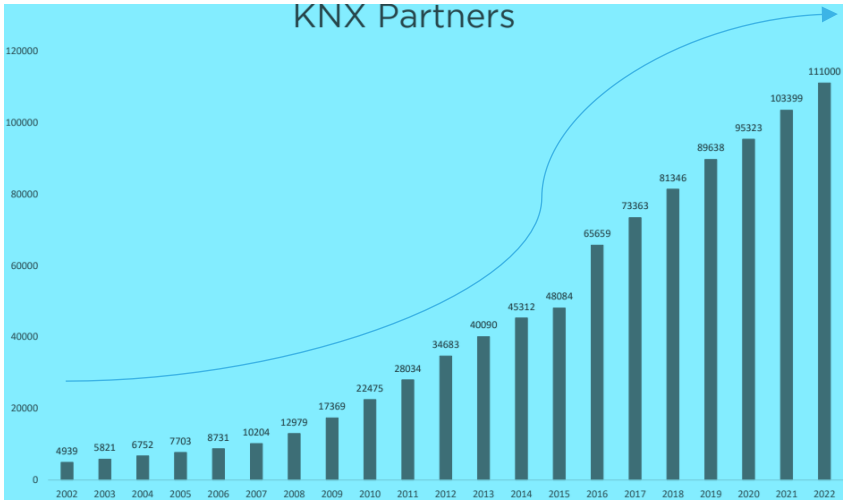
life.augmented

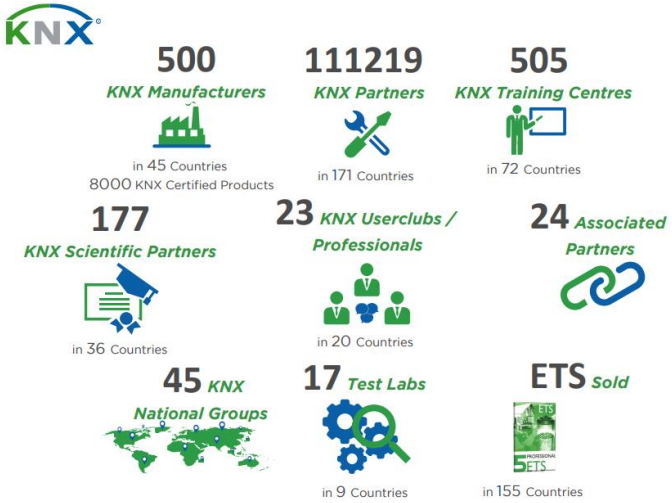
# KNX In Smart Home And Building Automation

**KNX is an open worldwide standard for home & building automation, covering various products from many manufacturers**

Approved standards:

- International standard (ISO/IEC 14543-3)
- European standards (EN 50090, EN 13321)
- US standard (ANSI/ASHRAE 135)
- **Chinese standard (GB/T 20965).**





life.augmented

*Data as of February 2023

# KNX Advantages-1


Standard

- KNX is the worldwide **standard** for home and building control

Interoperability


- KNX guarantees **interoperability** and interworking of certificated products


High quality

- KNX stands for **high** product **quality**: ISO 9001

One Tool-ETS


- A **unique** manufacturer of independent engineering **tool** software: **ETS®**


All applications

- KNX can be used for **all application** areas in home and building control

# KNX Advantages-2

- KNX is fit for use in **different** kind of **buildings**: commercial, residential
- KNX supports **several** communication **media**: TP, RF, PL, IP
- KNX supports **different** configuration **modes**: E-mode, S-mode.
- KNX can be **coupled** to **other systems**: BACnet, DALI, etc.
- KNX is **independent** from any **hardware** or **software** technology

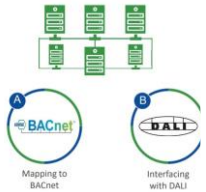
All kinds of buildings

Different media



Different config. modes

Easy coupling



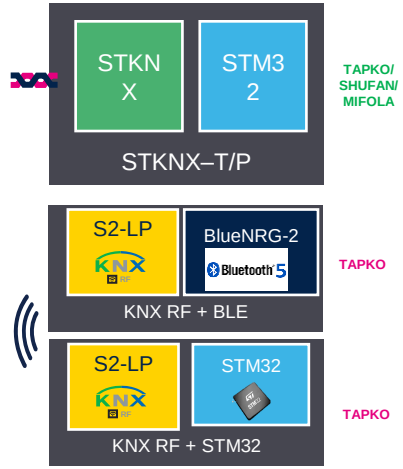

Hardware/software independent

Automation Competence Center

# Connectivity Medium Options

## ST delivers twisted pair wired and RF wireless solutions

| | Medium | Transmission via | Preferred areas of application |
|---|---|---|---|
| ST | **Twisted pair** | Separate control cable | • New installations<br>• Extensive renovations<br>• Highest level of transmission reliability |
| ST | **Radio frequency** | Radio line | • When no cable can be installed |
| | **IP** | Ethernet/Wi-Fi | • In large installations where a fast backbone is needed<br>• For communication with mobile devices |
| | **Powerline** | Existing network<br>(neutral conductor must be available) | • If no additional control cable can be installed<br>• When 230 V cable is available |

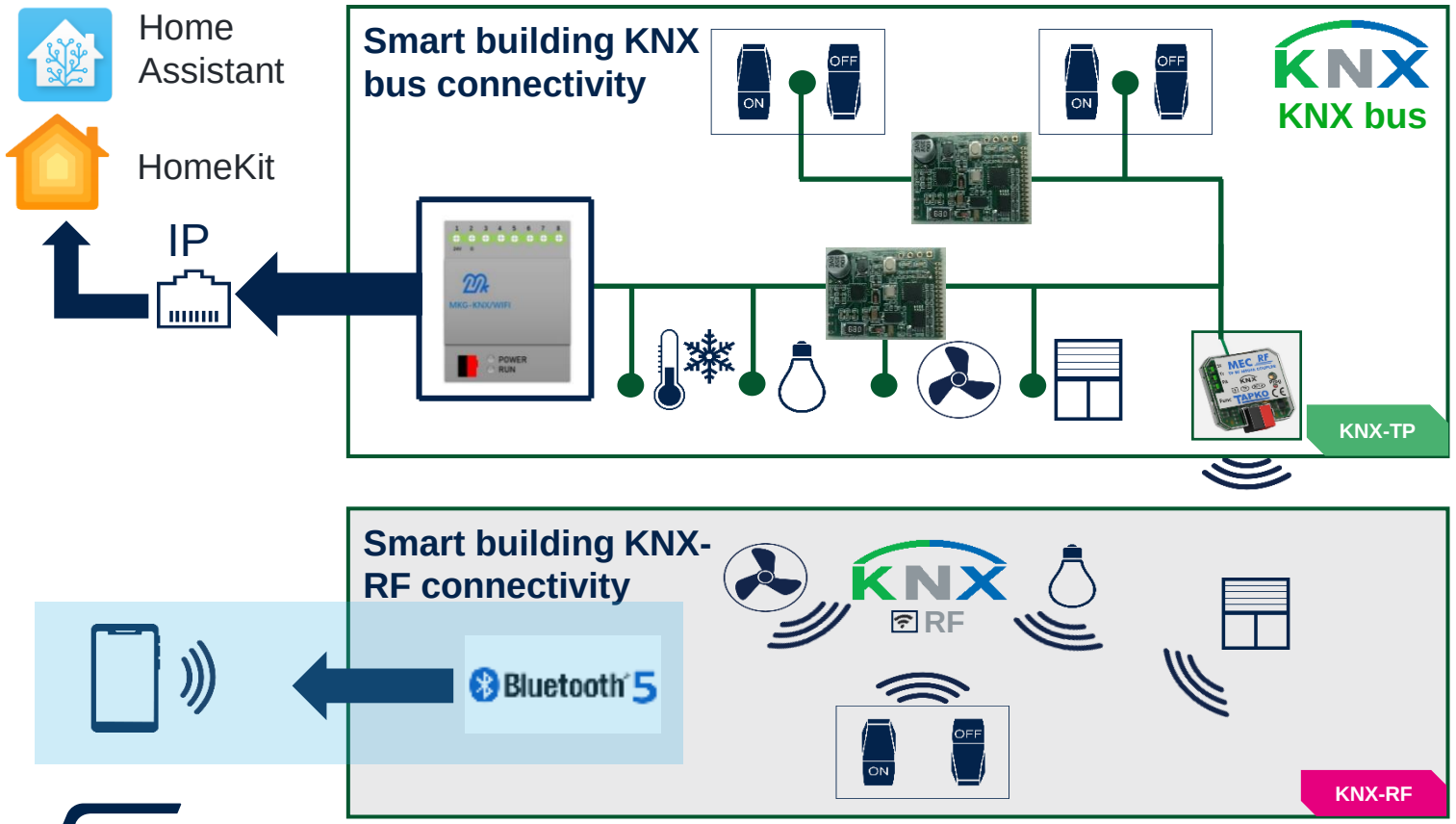



life.augmented

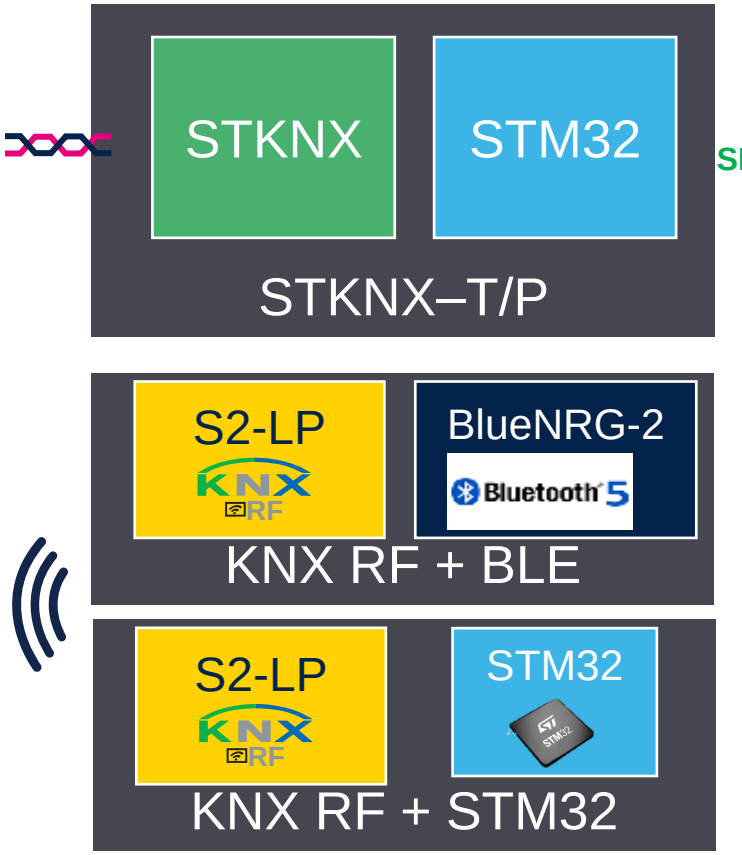
Automation Competence Center

# ST Certified Chipsets To KNX Ecosystem Building Automation

## Wired and wireless KNX connectivity with Bluetooth® Low Energy




KNX stack



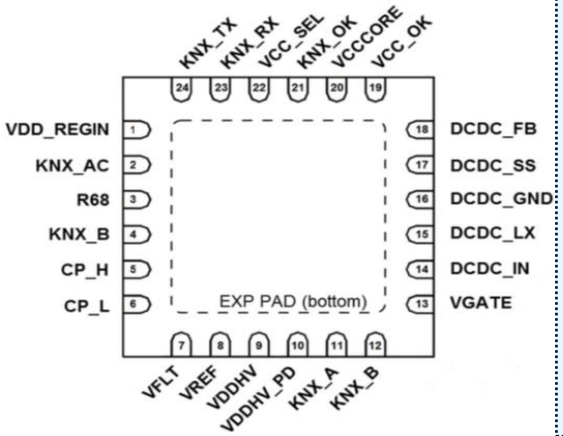

life.augmented

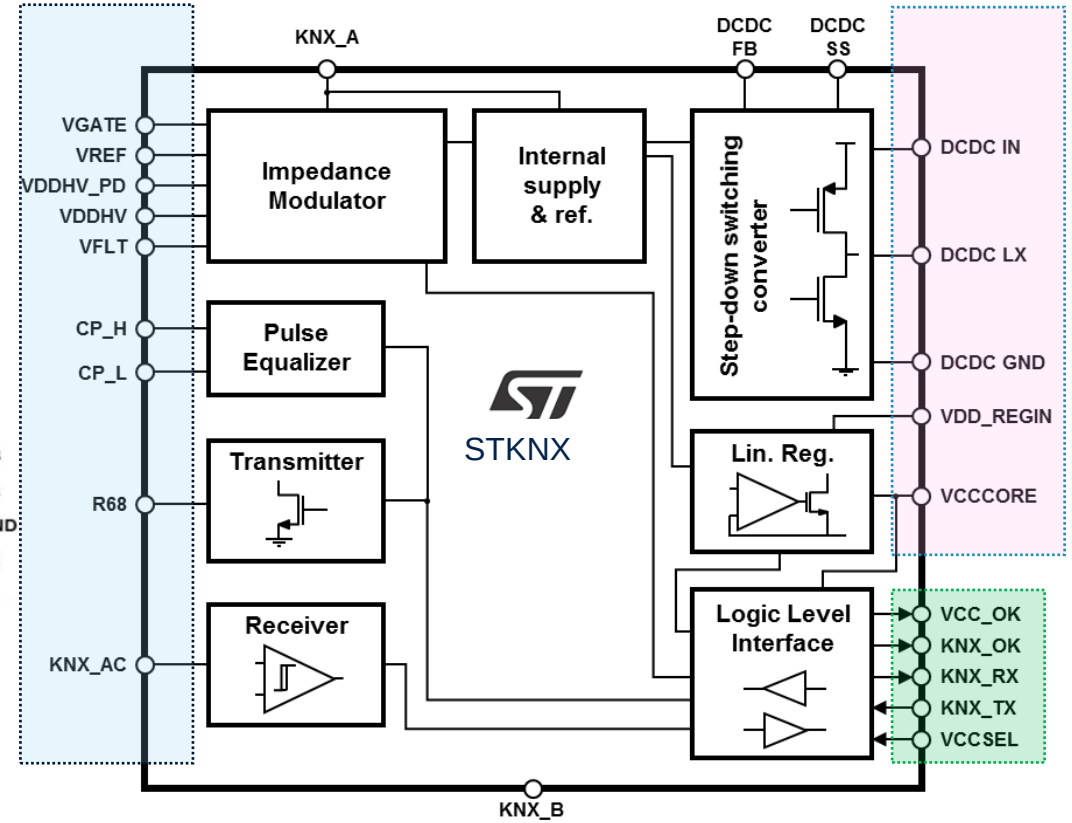
Automation Competence Center

# KNX TP Solution - STKNX Chipset

**STKNX transceiver device for KNX TP communication; small package and few external components enable the very compact KNX nodes**

4x4 VQFNPN
24-lead package



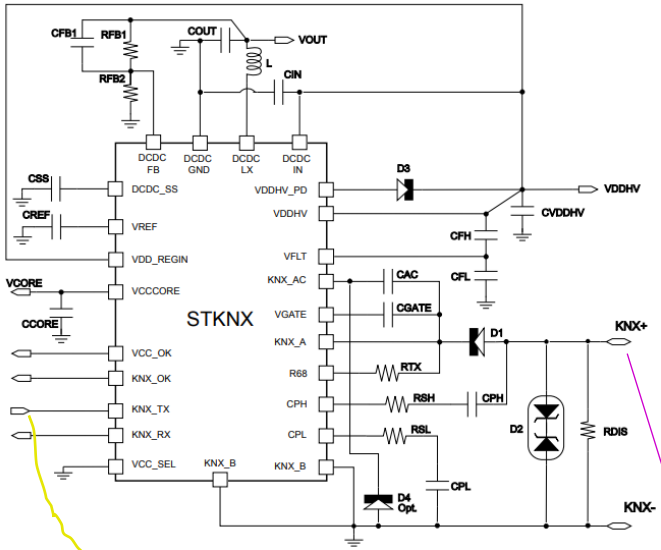



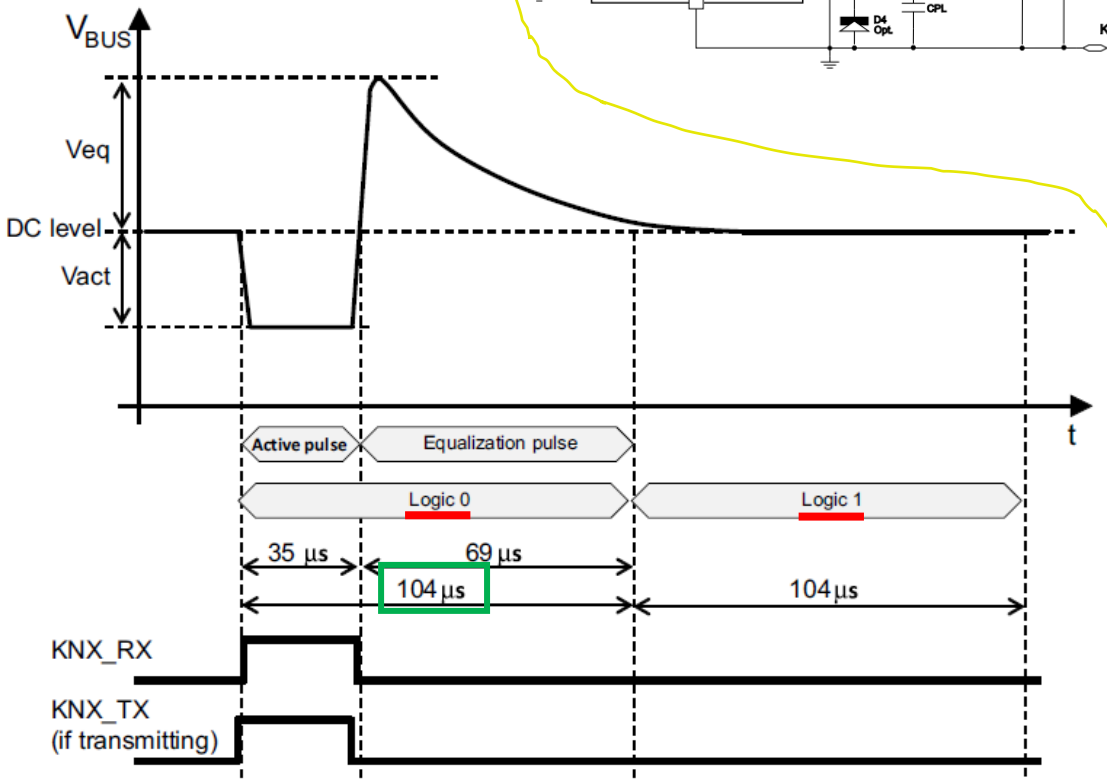

- KNX certified, KNX TP1-256 supported.
- Very small system solution
- Supports bus current up to 30 mA (fan-in 3)
- Easy “bit" interface to MCU
- No crystal required
- 2 integrated voltage regulators for external use in application.
  - Selectable 3.3 V/5 V, 20 20 mA linear regulator
  - Adjustable 1-12 V, 150 mA high efficiency DC-DC switching converter
- Recommended list of passive parts is supplied in datasheet and schematics

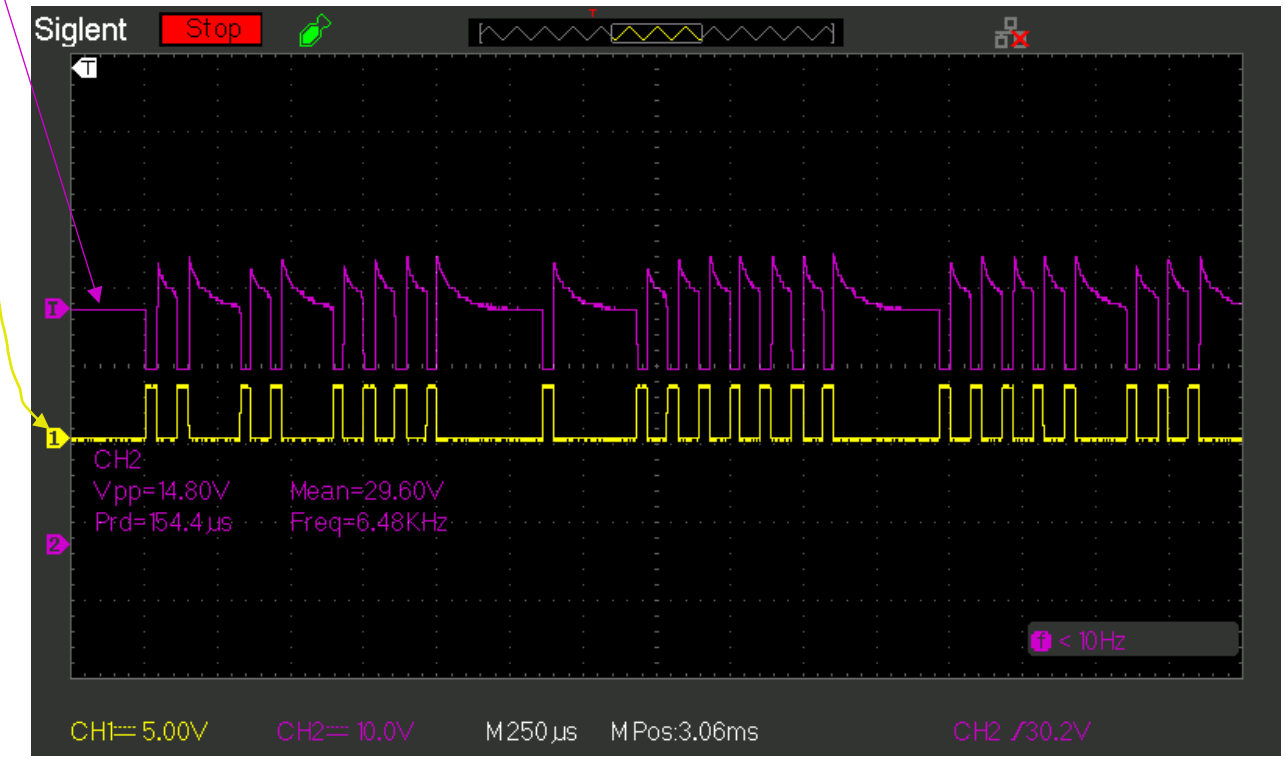
- Bus interface
- Voltage regulators
- µC interface

life.augmented

# KNX BUS Waveform



# STKNX Function Blocks


Control panel

RGB LED backlight

STM32 F0/G0 70

ST ISO 621/620

STKNX

SMAJ 40CA

Touch keypad

Sensor

VL53L0X VL6180X

STM32 G070

ST ISO 621/620

STKNX

SMAJ 40CA

Bluetooth

PSU

Bluetooth

AREA LINE BUS DEVICE

A A A A . L L L L . B B B B B B B B

0…15 0…15 0…255

SMAJ 43CA

STKNX

ST ISO 621/620

STM32 G070

ULN 2003

Lightings (ON/OFF)

SMAJ 43CA

STKNX

ST ISO 621/620

STM32 G070

MOS FET

Lightings (Brightness adj)

SMAJ 43CA

STKNX

ST ISO 621/620

STM32 G070

RS-485

Air conditioning

SMAJ 43CA

STKNX

ST ISO 621/620

STM32 G070

RS-485

Window shutters

life.augmented

# S2-LP Sub-1 GHz Transceiver

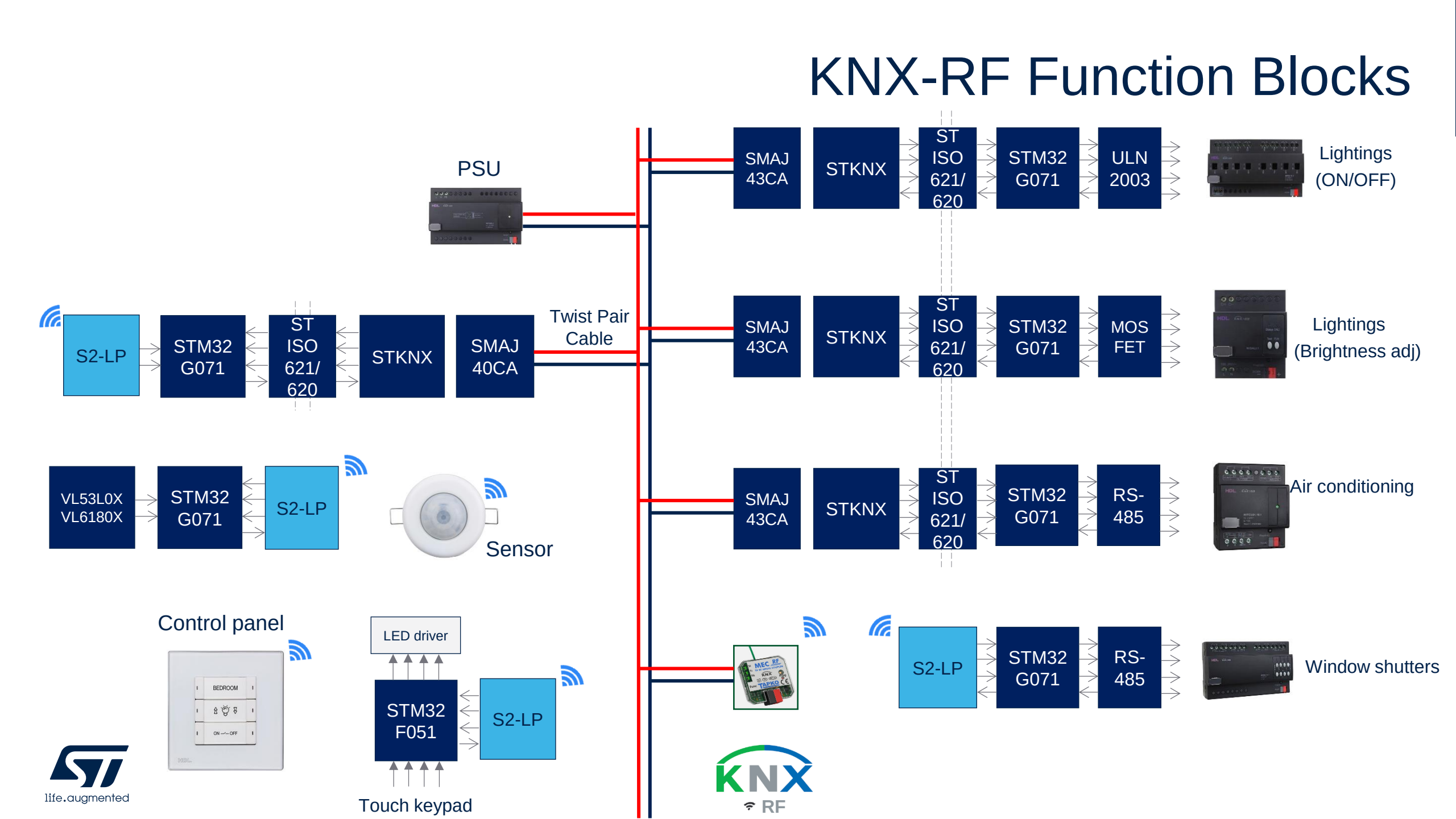
**Generic S2-LP transceiver covers all KNX-RF radio bands: 433, 868 & 915 MHz (868 MHz certified only) and protocol requirements**


**S2-LPQTR**
- 430-470 MHz & 860-940 MHz
- -40°C to +105°C
- QFN24 4x4x1

- State-of-the-art power consumption as wireless applications do not access main power (e.g., KNX-RF switches)
- 10-year longevity commitment

| S2-LP power state | S2-LP current (@ 3v) |
|---|---|
| Tx @ +10 dBm | 10 mA |
| Tx @ +14 dBm | 20 mA |
| Rx in LPM | 7 mA |
| KNX-RF multiscan | <10µA average |
| Shutdown / leakage | 2.5 nA |

# KNX-RF Function Blocks



Automation Competence Center

# ST Assists Rapid KNX Development

## KNX product development flow

**Apply to KNX member**

**Select STKNX chip**

STM32G0+ STKNX

**Select KNX stack profile**

Tapko/ Shufan/ Turing-Think/ Own/ etc.

**KNX application development**

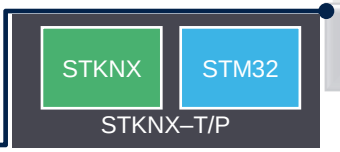
KNX members/ Manufacturers

**ETS database development**

**KNX product certification**

## Why ST KNX platform

Lowering the **price** barriers




### High performance-cost ratio

**Competitive price solution:** **STKNX** transceiver and value line MCU **STM32G0**

**Wide product portfolio:** MCU, connectivity, sensors, GPA, etc.

Lowering **technical** barriers

TAPKO technologies SHUFAN 麦克方程

### Wide customers and partners

**Many KNX stack 3rd parties:** Tapko, Shufan, Turing-Think, Mifola, etc..

**KNX top players cooperation:** Tantron, GVS, Seawin, etc.

**Large customer base:** Over 80+ KNX customers

Accelerate **development** process

### Multi-completed solutions

KNX total solution implemented in ST office

Various demo boards

KNX charging station

KNX energy management

### Comprehensive training and support

Training: 21IC, webinar, seminar, etc.

Direct ST support

Support Joint Lab

Lots of distributors involved

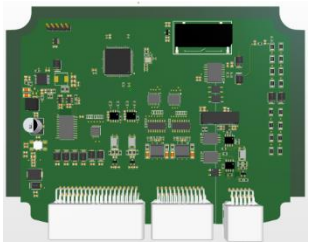
# STKNX For Energy Management System

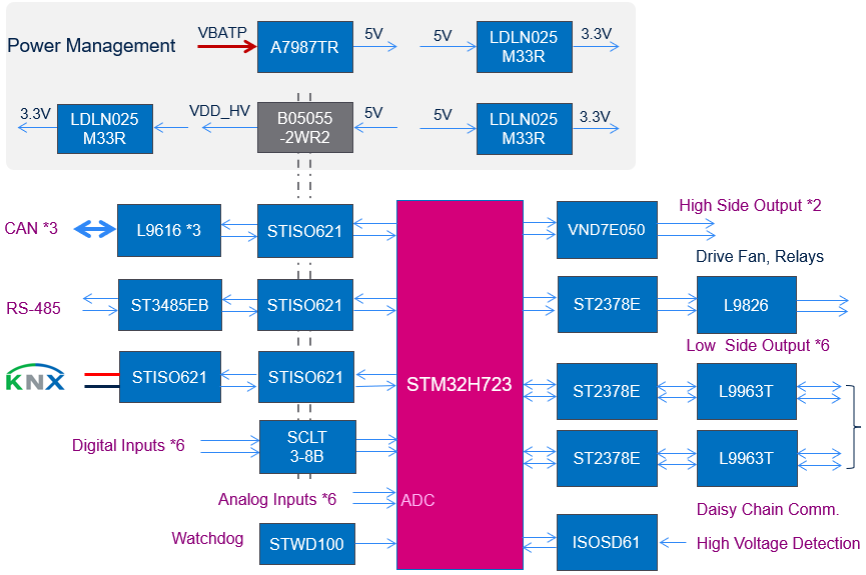

life.augmented

# KNX Applications In Energy Management

- Lighting
- Heating, Ventilation & Air conditioning (HVAC)
- Blind and Shutter Control
- Automation and Remote Access
- Security and Safety
- Operation and Visualisation
- Energy Management/Smart Metering
- Other

Metering, data logging, visualization, current detection, fuel, or water tank level control, peak demand monitoring, load shedding, energy harvesting, renewable energies, battery storage

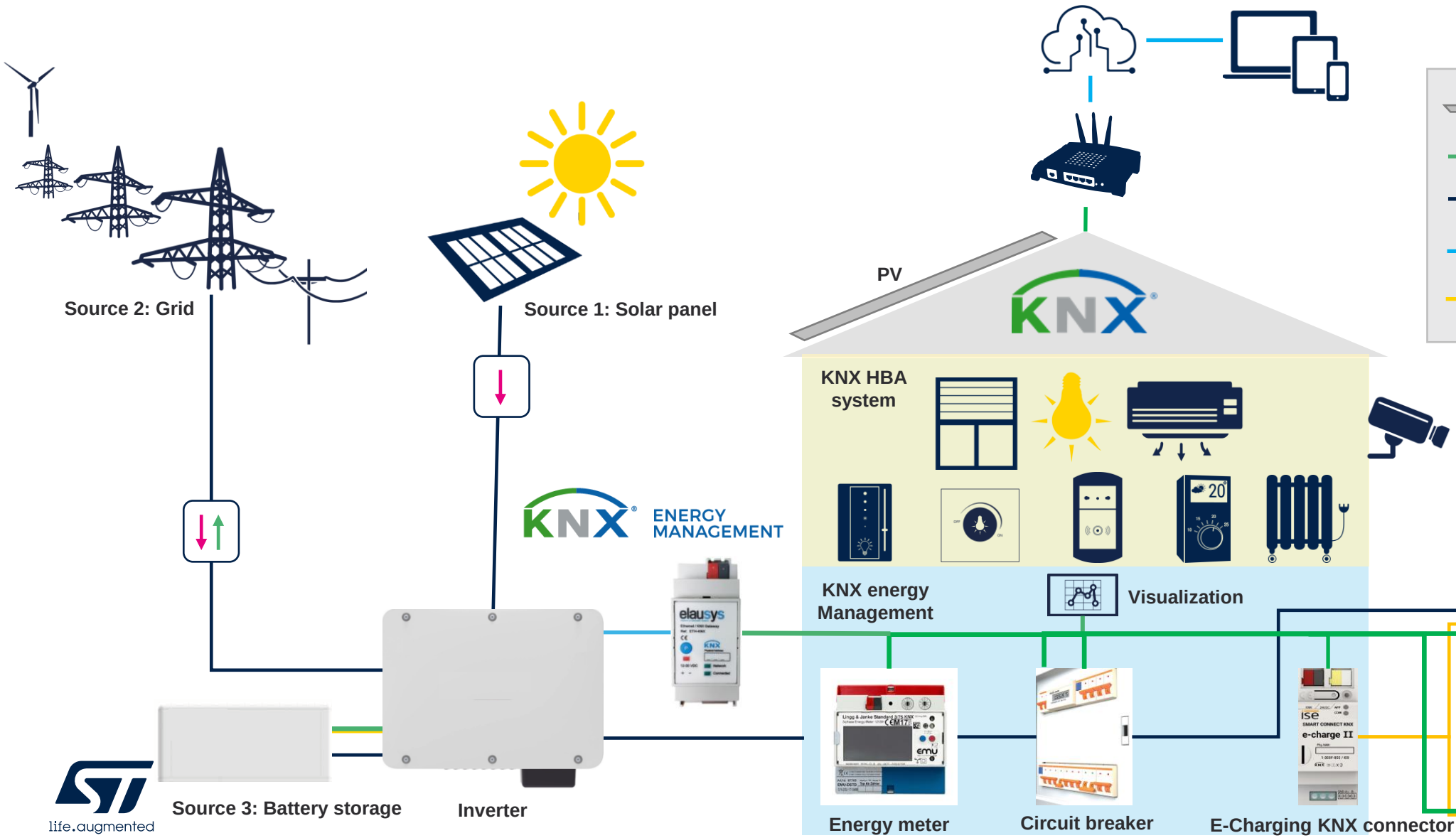




Automation Competence Center

KNX Data Secure

# KNX Energy Management System




life.augmented

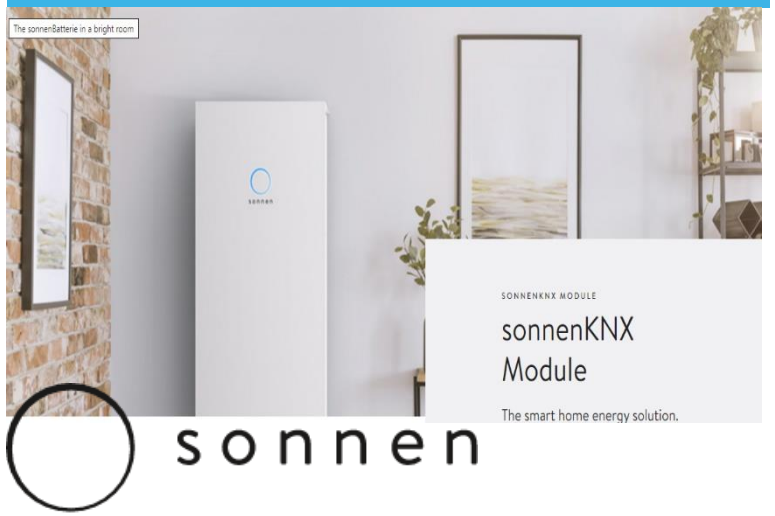
Automation Competence Center

# Enablers Of KNX Energy Management

## KNX gateway for solar inverters


- KNX gateway for solar panel inverters
- Elausys link

## KNX smart home energy solution




- A high-tech storage system that allows to cover about 75% of the yearly energy requirement with self-produced and clean energy
- Sonnen link

## Electromobility in KNX smart home


- Dynamic load management and SMART CONNECT KNX e-charge II. Easily integrate up to 5 charging points from different manufacturers into the KNX.
- iSE - link

Source: https://sustainabilityknx.org/

Automation Competence Center

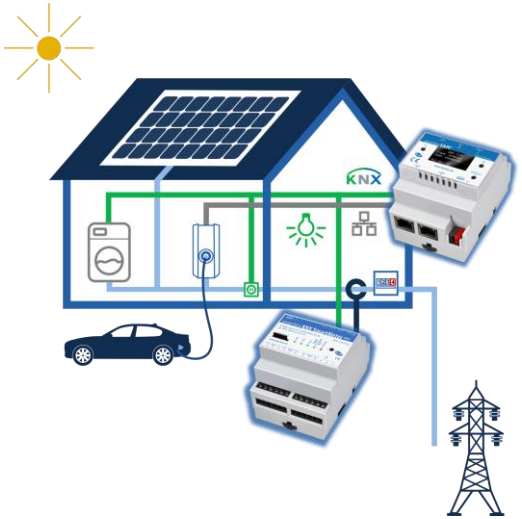
# Use Cases In KNX Energy Management

KNX ENERGY MANAGEMENT

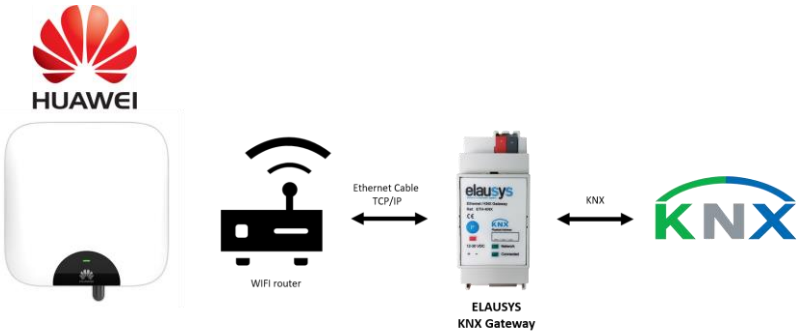

- **Reduce energy costs:** reduce energy costs up to 30% by optimizing energy usage
- **Optimize energy:** maximize the use of self-generated solar energy
- **Smart charging:** charge your electric vehicle and other devices when energy demand and prices at lowest
- **Smart scheduling:** run appliances when energy demand and prices are lowest
- **Carbon reduction:** reduce your carbon footprint

Arial

XXTER KNX Smart energy Management




EibPC2 KNX Home energy Management




Elausys KNX gateway for Huawei Inverters

- KNX interface for **Huawei SUN2000** inverter series
- Monitoring of **energy, power, current, voltage, frequency, temperature**,…
- Connected to the inverter over Ethernet
- **Galvanic insulation** from the **KNX** bus
- **Configurable** refresh rate of inverter data
- DIN rail mounted and auxiliary power supply 12-30 VDC
- **Advanced logic functions** including weekly calendar, sequences, math, logic gates and triggers
- Different **KNX devices** from different **vendors** communicate without any problems

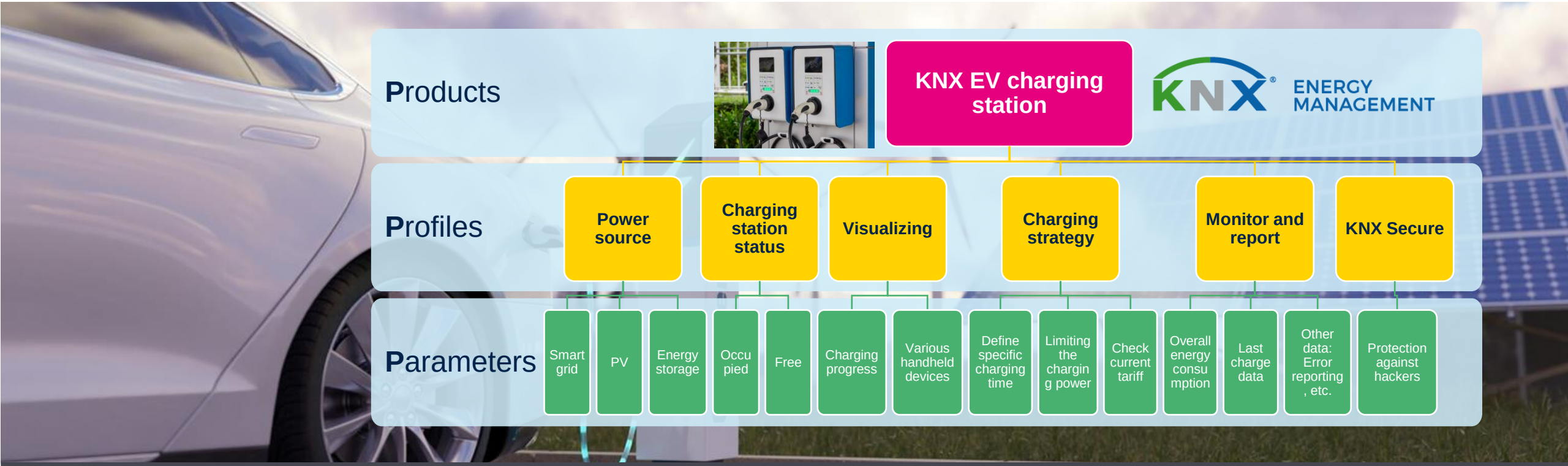
Sonnen KNX module for Smart Home energy

life.augmented

Sources: KNX Org.

Automation Competence Center

# KNX EV Charging Station Key Profiles

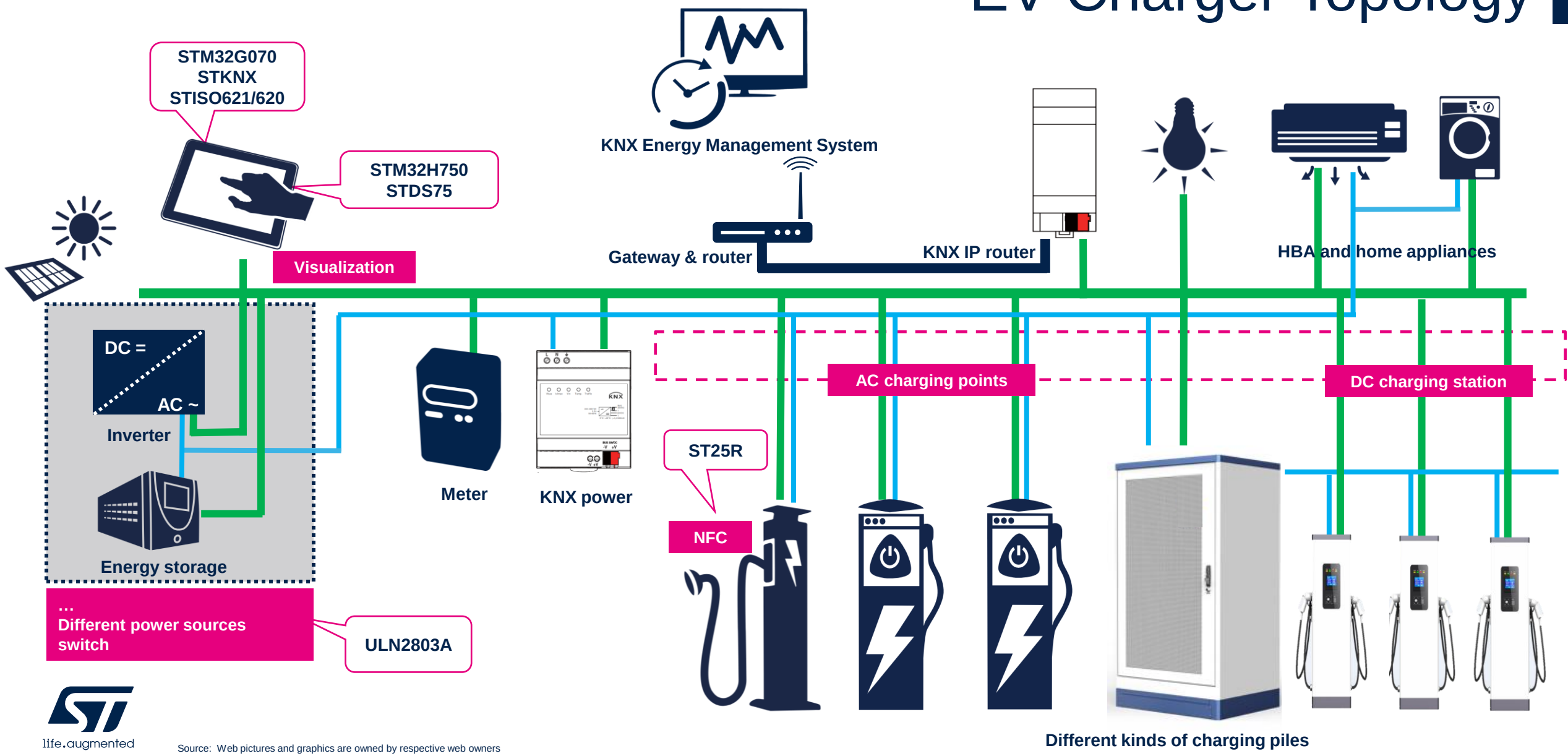



1. The EV market is clearly growing, and the demand for charging vehicles whilst at work/home will increase as the market expands.
2. KNX provides the mechanism to do this intelligently and securely, by integrating the charging of EVs within an energy management system that already covers all aspects of a home or building's energy consumption and generation.
3. **07B0h KNX stack** is a recommend KNX configuration profile for EV charging station device, more than **2000** communication objects & parameters are supported by this profile.

Sources: KNX Org.

Automation Competence Center

# KNX Energy Management & EV Charger Topology




Different kinds of charging piles

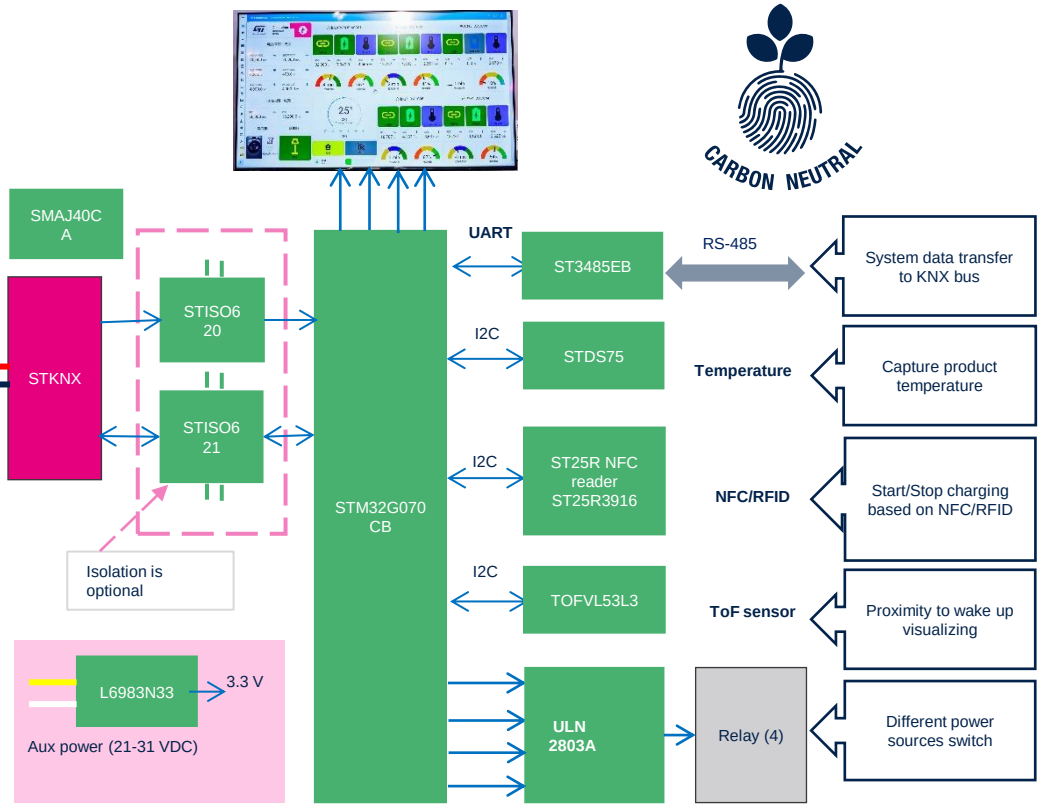
life.augmented

Source: Web pictures and graphics are owned by respective web owners

Automation Competence Center

# Smart KNX EV Charging System

## Accelerating EV car transition with cost-effective EV charging infrastructure

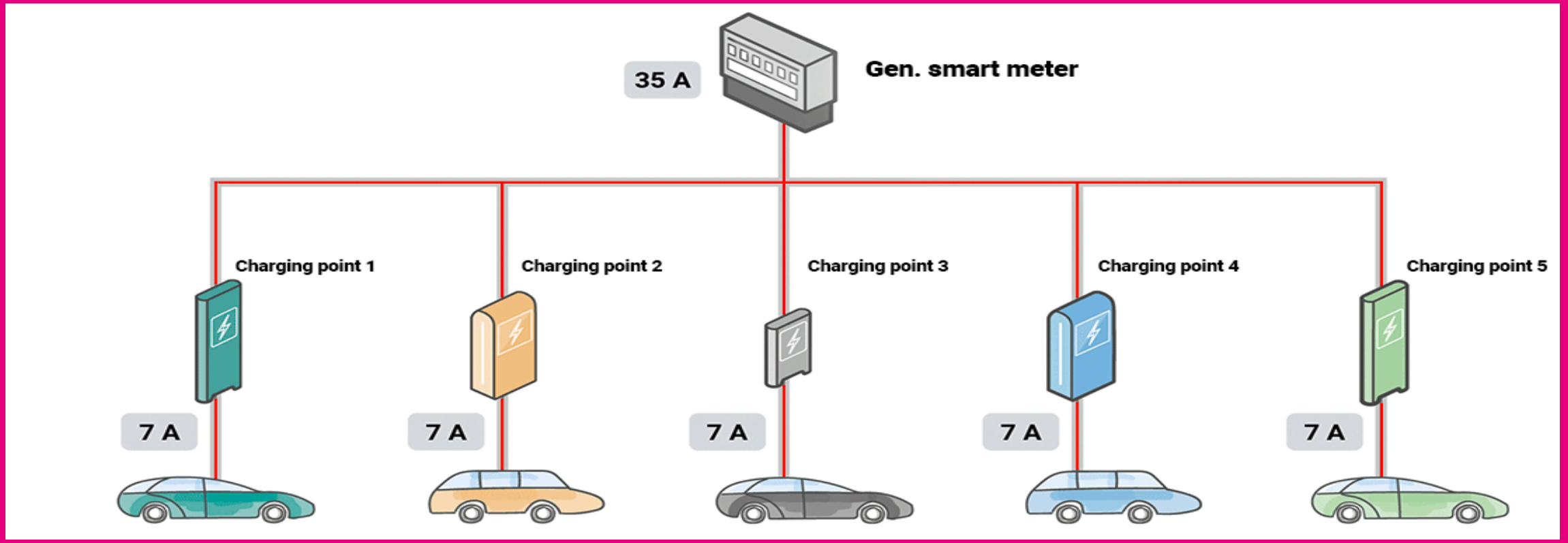

[Demonstration video available for download]

life.augmented

Automation
Competence
Center

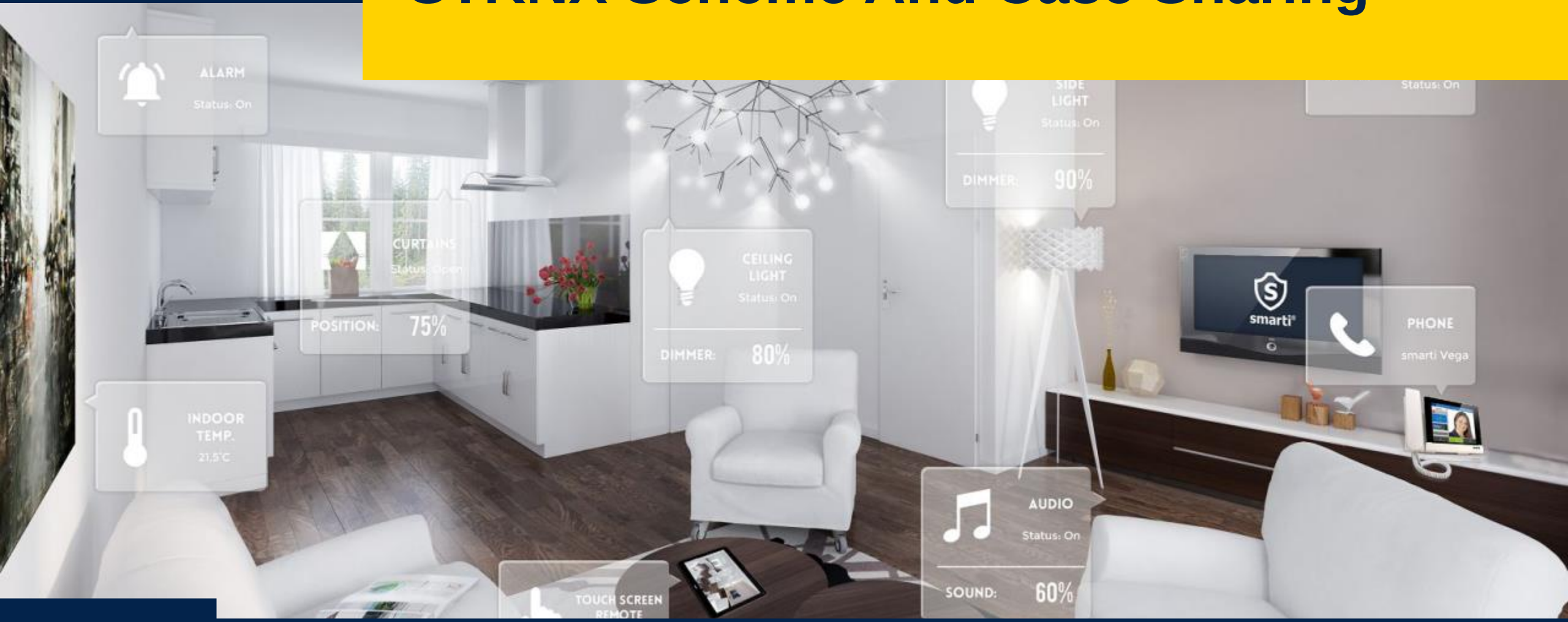
# KNX Energy Management System Solution

## Example of KNX system




life.augmented

# STKNX Scheme And Case Sharing



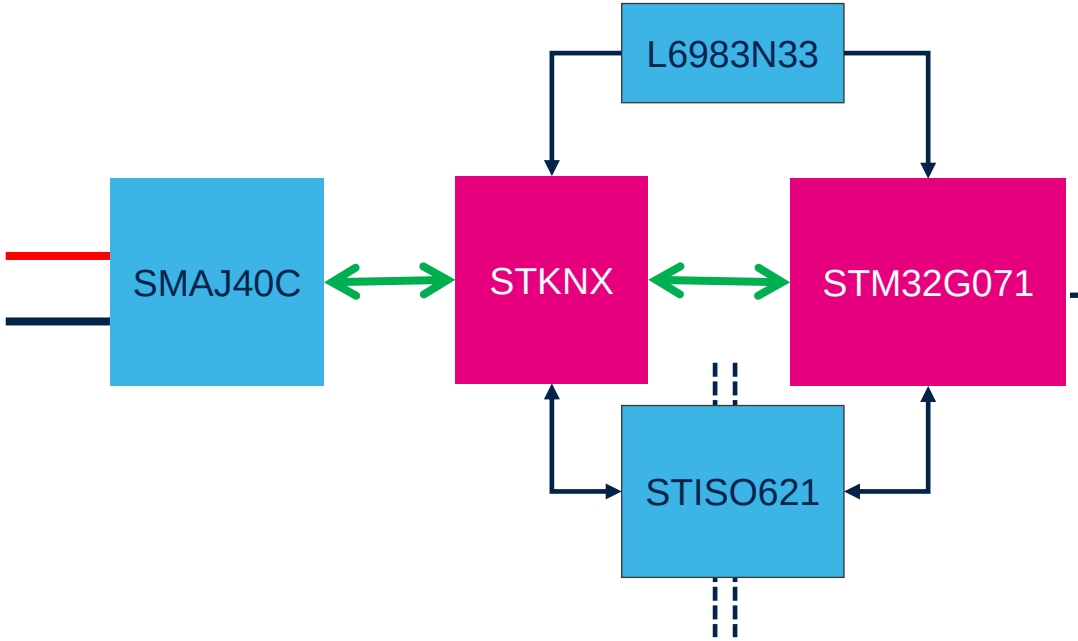

life.augmented

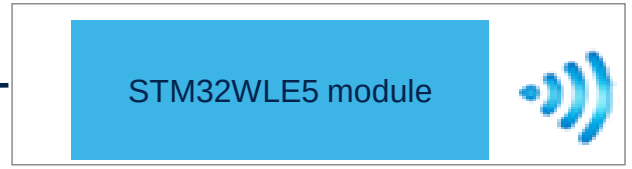
Automation Competence Center

# Smart Home, Building, And City Solutions And Support

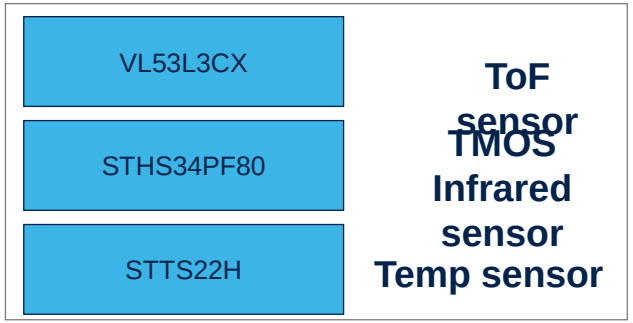
## Home, building & city

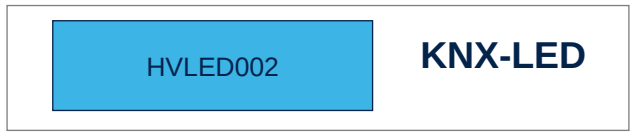
## Customizable, adaptable, and flexible platforms

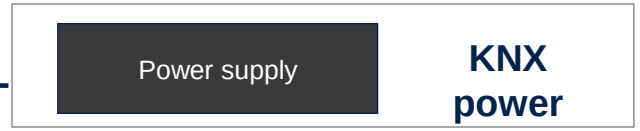




**KNX-to-LoRA module**

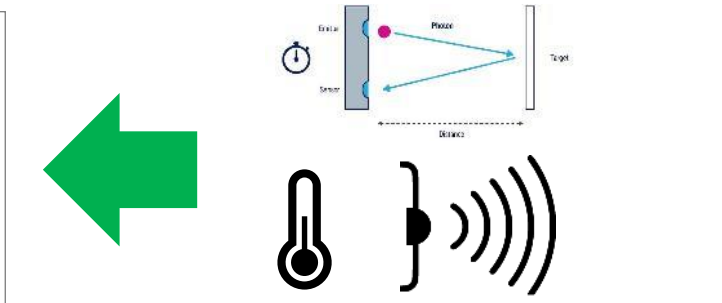


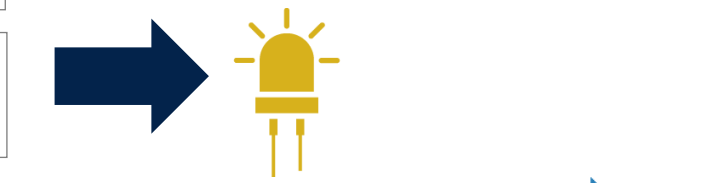








**…….More**




**Industrial power**

life.augmented

Automation Competence Center

# ST KNX Reference Solutions

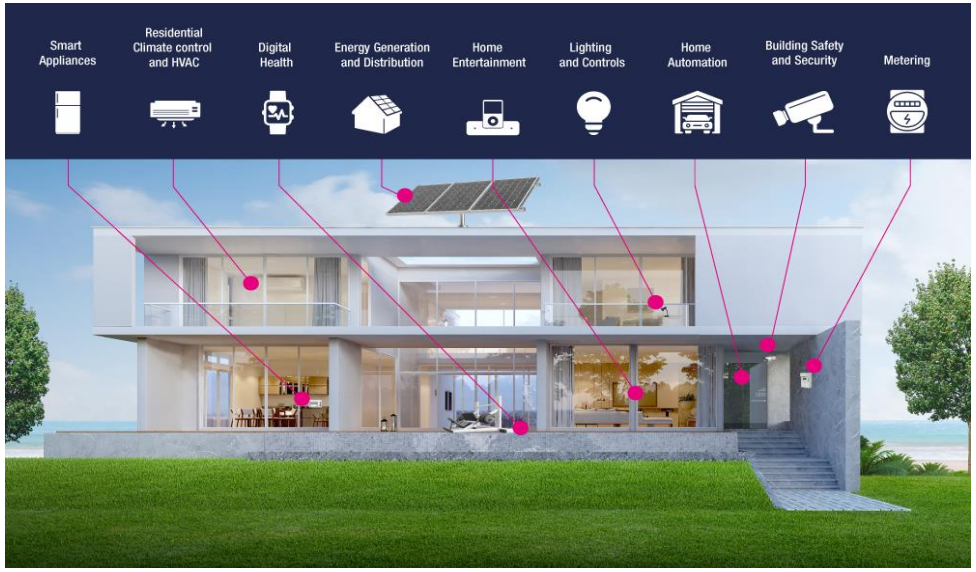
IA.BA 0005.20
KNX-LoRa project based on STM32WL STKNX

IA.HA 0005.20
Slim Board for BlueNRG to KNX

IA.BA_0020.23
KNX CO2 sensor project

IA.HA 0013.21
KNX-RF General function board project

IA.HA_0018.22
KNX-Touch-Panel MP1 Harmony OS




IA.HA_0024.23
*RS-485 to KNX bridge/gateway

IA.HA_0017.22
*KNX Smart knob with haptic


IA.BA_0022.23
*KNX RFID reader

IA.HA_0014.22
KNX TMOS & PIR sensor

IA.HA_0020.23
KNX actuator of RGBW dimming control

IA.HA 0021.23
KNX-4ch switch on/off actuator

IA.HA 0006.20
STKNX module

IA.BA_0013.22
STKNX evaluation and development board

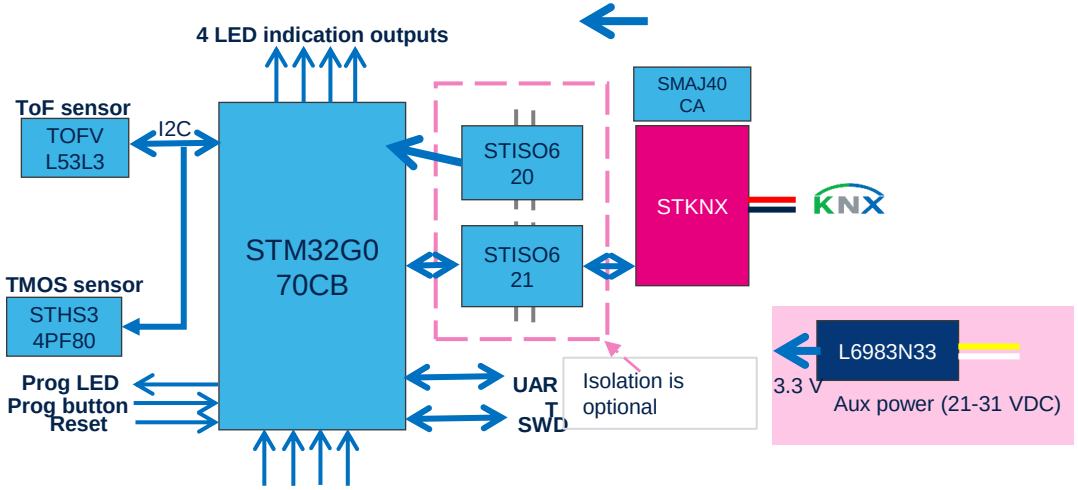
life.augmented

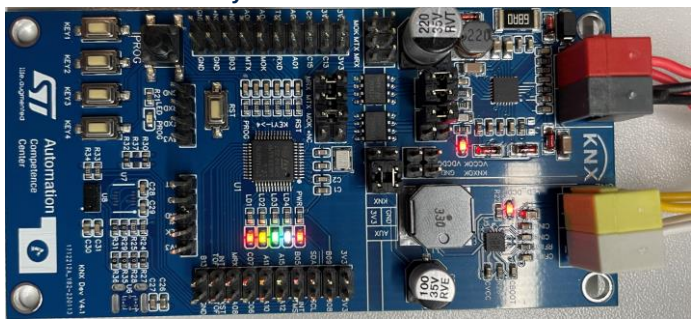
Notes: * Coming soon

Automation Competence Center

# STEVAL-STKNX1CBA

## Contact ST Automation CC for free KNX development SDK (evaluation version only )



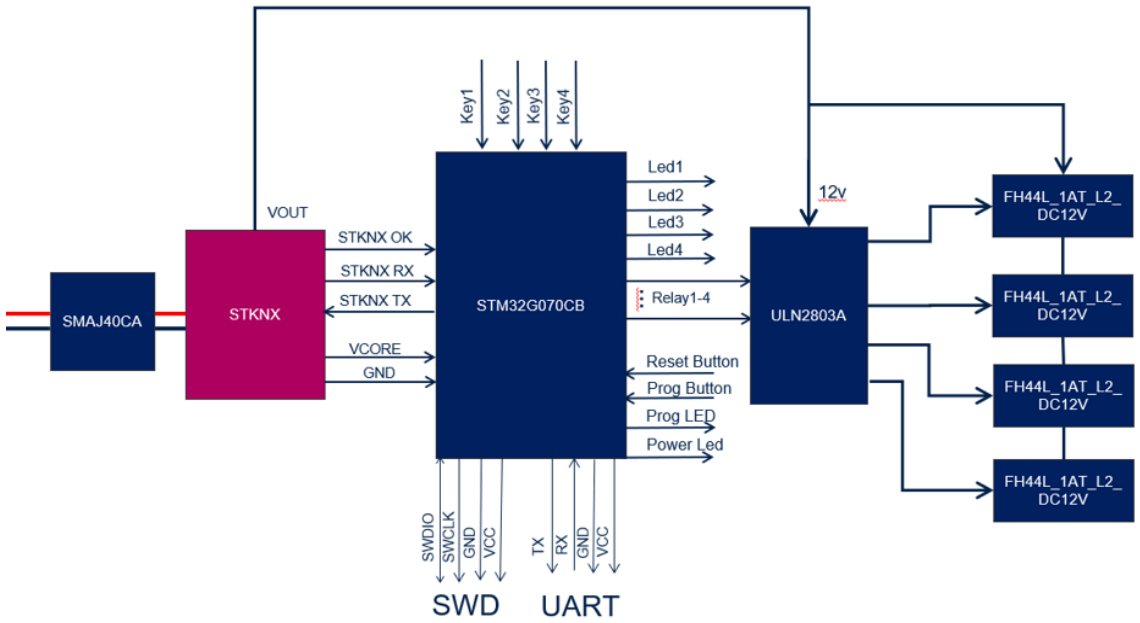
Development board with STKNX as KNX device transceiver, low power STM32G070CBT6 as main controller, STISO621/620 as isolated device and L6983N33 as power supply device. Integrated STHS34PF380 and VL53L3CX for KNX sensor development. all the necessary components both to evaluate the performances of the STKNX circuit and to develop a KNX device on twisted pair medium according to the TP1-256 standard.

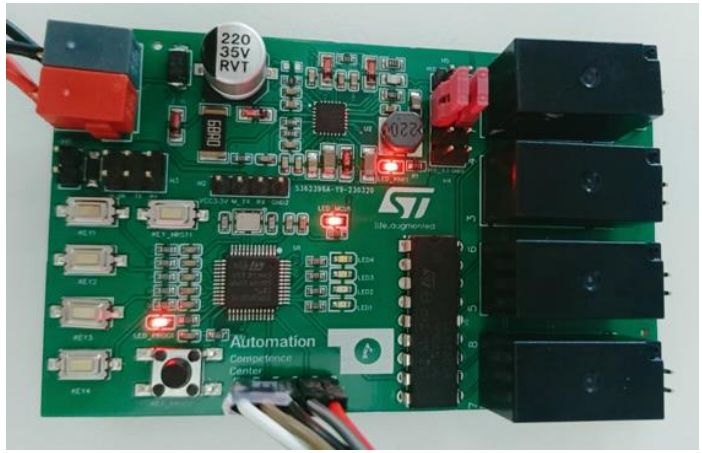
An open SDK with SHUFAN KNX stack protocol and an ETS database are available for this board; the SDK and ETS DD can be used by customer for study and estimation.

- Full KNX twisted pair device development kit based on the STKNX miniature transceiver.
- Controlled by STM32G070CB microcontroller 32-bit Cortex®-M0+ MCU with 64 MHz - 128 KB flash.
- 1 button and 1 LED for KNX programming
- 4 buttons and 4 LEDs for basic KNX sensors and actuators emulation
- Optional isolation between STKNX and STMG070CB
- Auxiliary power supply is available
- Open SDK with KNX stack for customer prestudy and estimation.
- A reference ETS DD with 15 communication objects and parameters can be modified for customer own application system.
- Two sensors(ToF and TMOS) are integrated for developing smart home/building application

life.augmented

# STEVAL-4KNXDVCB




Board with STKNX as KNX device
transceiver, low power STM32G070CB as main controller, ULN2803A as relay driver chip.
The ULN2803A can provide an output voltage 50 V and current 500 mA.
This STEVAL-4KNXDVCB can use ETS software to set parameters to enable manual control and adjust action delay time of each channel.

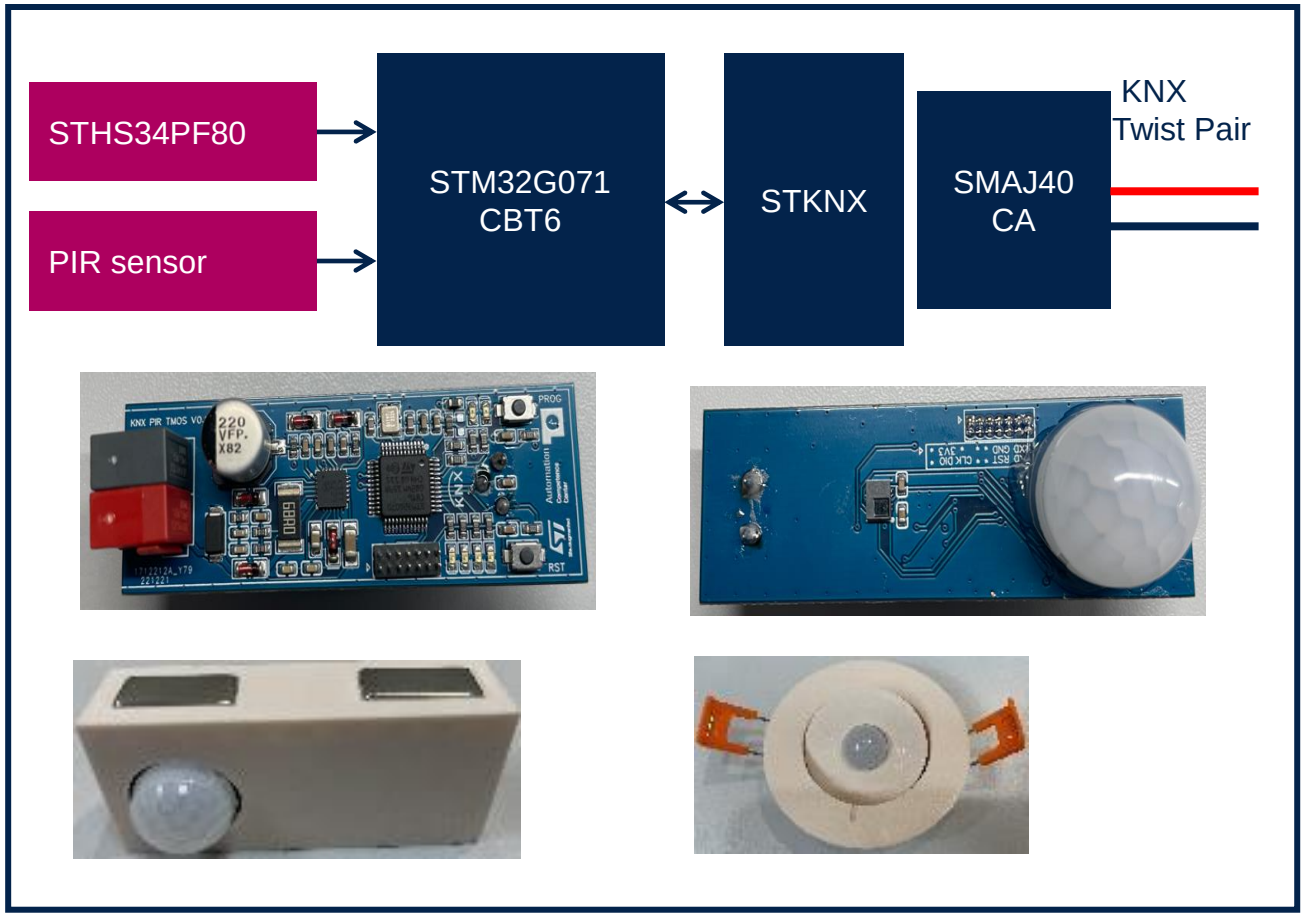
These evaluation boards are custom designed and built in small quantities, according to specific requests from customers and are destined for evaluation and testing of ST products in a research and development setting. Please contact ST to provide your specific requests and get your custom built boards.

- Input DC voltage: 21-32 VDC (KNX bus)
- KNX 4 channels switch on/off input
- KNX 4 channels relay output
- 4 keys and 4 LEDs indicator
- 4 relays parameter: 12 V, 500 mW, magnetic holding bus control and manual control
- Adjustable parameter of action delay of each channel
- Open SDK with KNX stack for customer's prestudy and estimation.
- A reference ETS DD with communication objects and parameters can be modified for customer own application system.
- No need for additional power supply for actuator board

https://www.st.com/en/evaluation-tools/steval-4knxdvcb.html

life.augmented

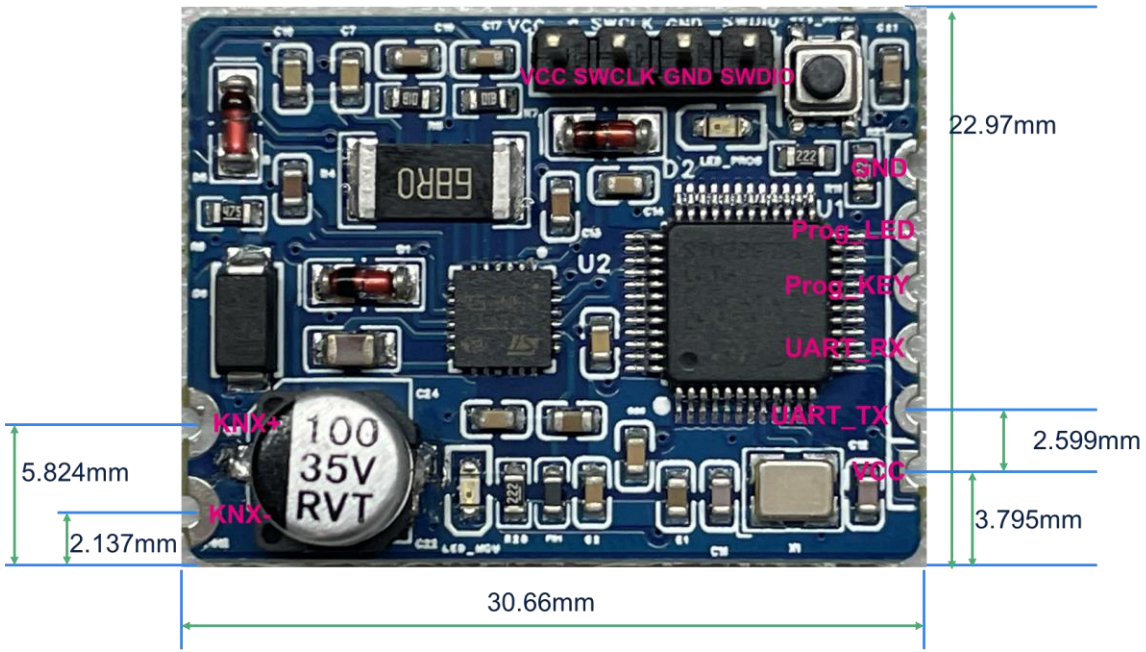
# Turnkey STKNX TP Solution




- Integrated TMOS and PIR advantage features for covering static human and wide range.
- Open SDK with KNX stack for customer's prestudy and estimation.
- Support two groups master/slave functions in a sensor for individual work with light and air condition at same time.
- A reference ETS DD with objects and parameters can be modified for customer own application system.

Automation
Competence
Center

# STKNX Module

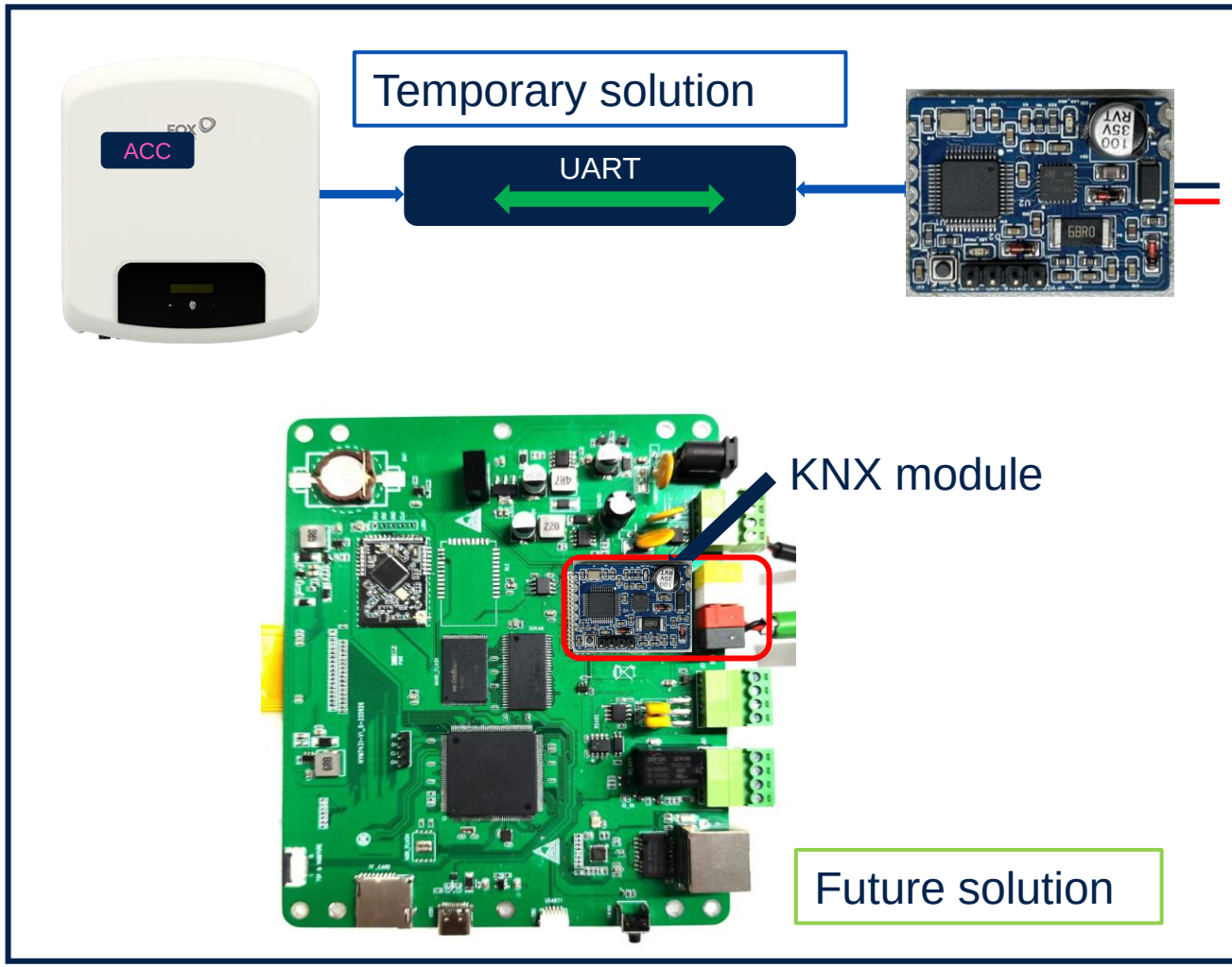



55 KNX communication objects and 18 UART communication command have been included.

## UART configuration

- Baud rate: 115200 Data length: 8 bits
  Stop bits: 1 bit Parity: None

Use case:




life.augmented

# Application Areas

Residential

Office buildings

Hotels

Airports

Hospitals

Schools & universities

Industrial buildings

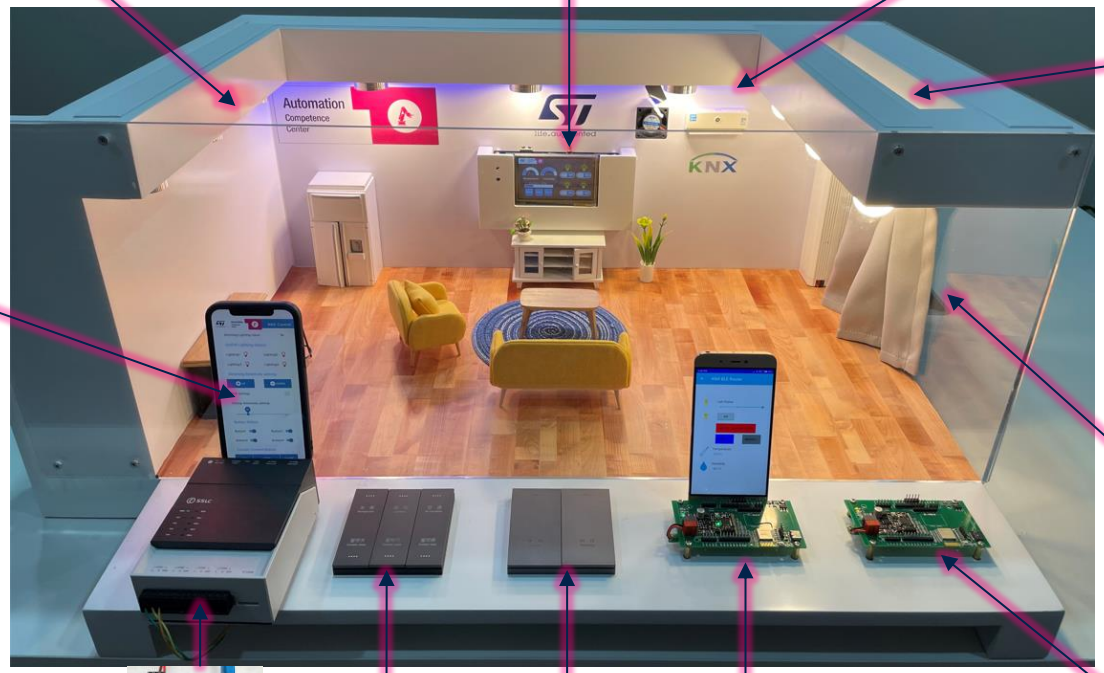
# Smart Home 3D Model With KNX Solution

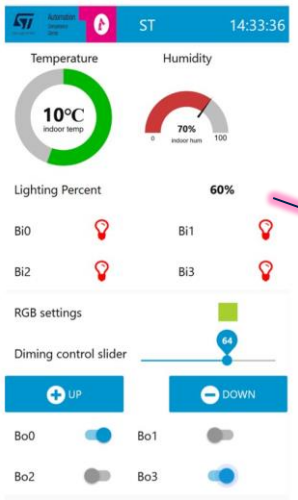
RGB lights

LCD display &Touch


On/off lights
& actuator

Dimming lights
&actuator




Web page HMI

Smart Curtain control

Edge Gateway and buttons control

KNX-BLE module

KNX-LoRa module

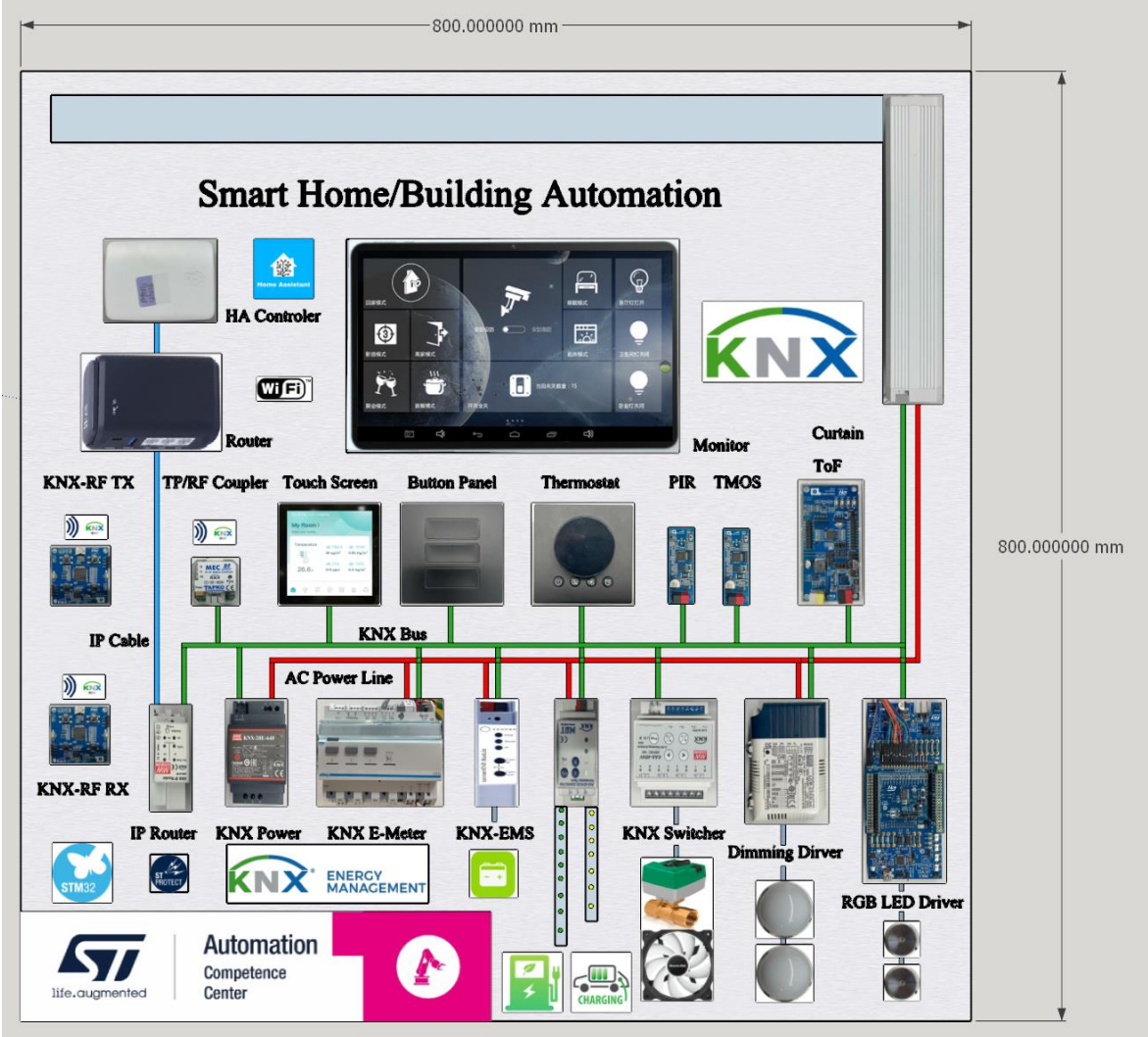
Main equipment included:
1:On/Off light
2:Dimming light
3:RGB color light
4:Smart Curtain control.
5:General on/off devices.

Control methods:
1:Local buttons panel.
2:Local LCD touch panel.
3:BLE APP.
4:LoRa server.
5:Web page.

System status display:
1:Local LCD.
2:BLE APP.
3:LoRa server
4:Webpage

life.augmented

# Automation Competence Center System Solutions - Home/Building Automation



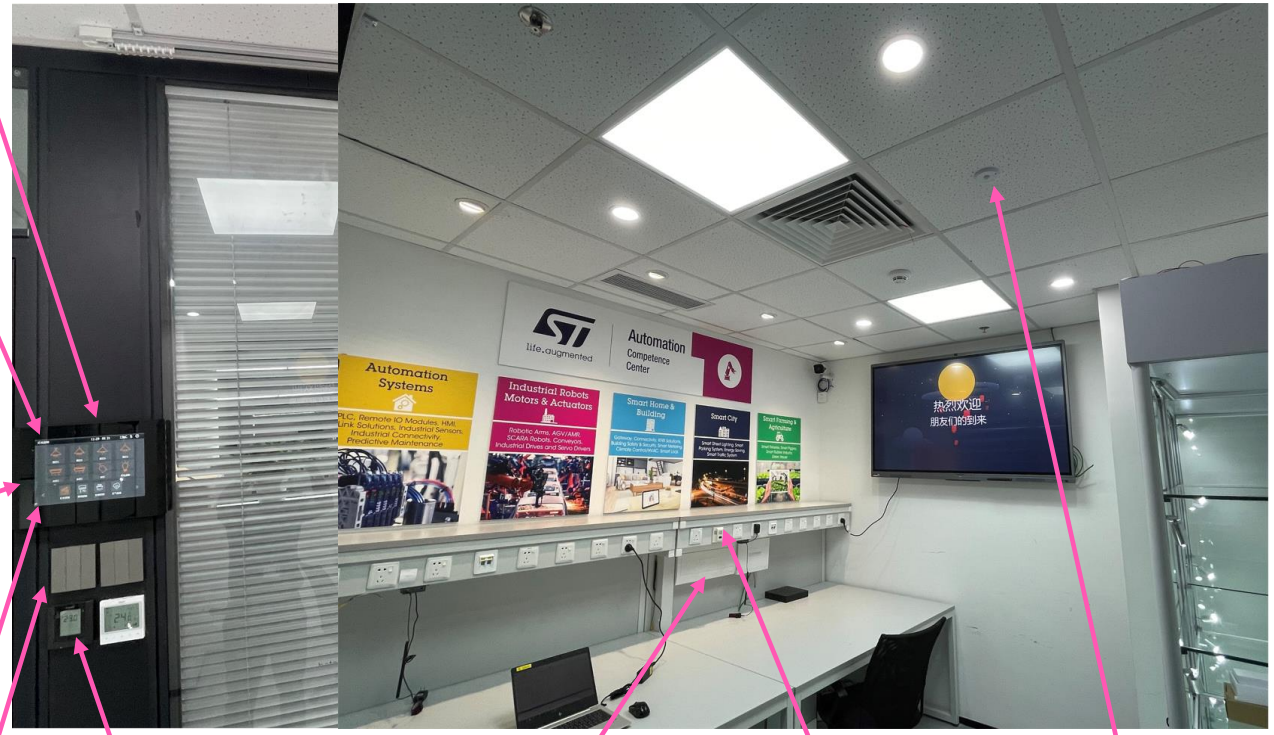

**Functions:**

- KNX push button and touch panel
- HAVL control panel
- KNX sensor of PIR, TMOS, ToF
- KNX actuator of ON-OFF control
- KNX actuator of HVAL control
- KNX actuator of LED dimming control
- KNX actuator of RGBW control
- KNX energy meter for energy management
- KNX actuator for EV charging-pile control
- KNX-TP/RF coupler for KNX-RF connection
- KNX-IP gateway to support home assistant

life.augmented

# KNX Intelligent Control Laboratory




Touch panel


Thermostat

KNX power and actuators

Air quality sensor

Motion sensor

## Installed KNX device

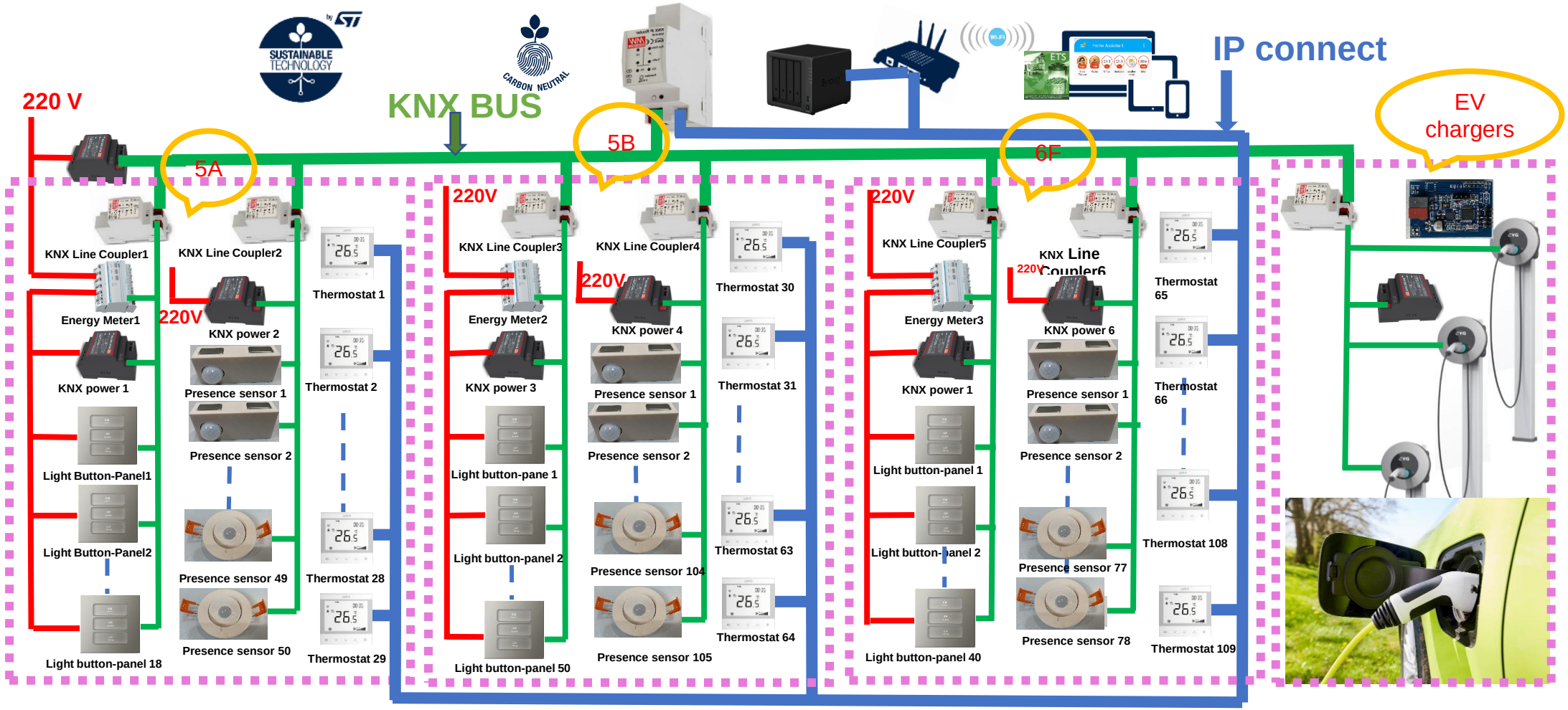
1: Touch LCD panel
2: Button
3: Thermostat
4: Air quality detection sensor
5: Human body motion detection sensor
6: Electric curtains
7: Actuator
8: KNX power supply

## Key features

1: Different types of light control
2: Electric curtains control
3: Air conditioning control
4: Air quality detection
5: Light and air conditioning intelligent control with human body movement detection
6: KNX end devices control and status display on TV

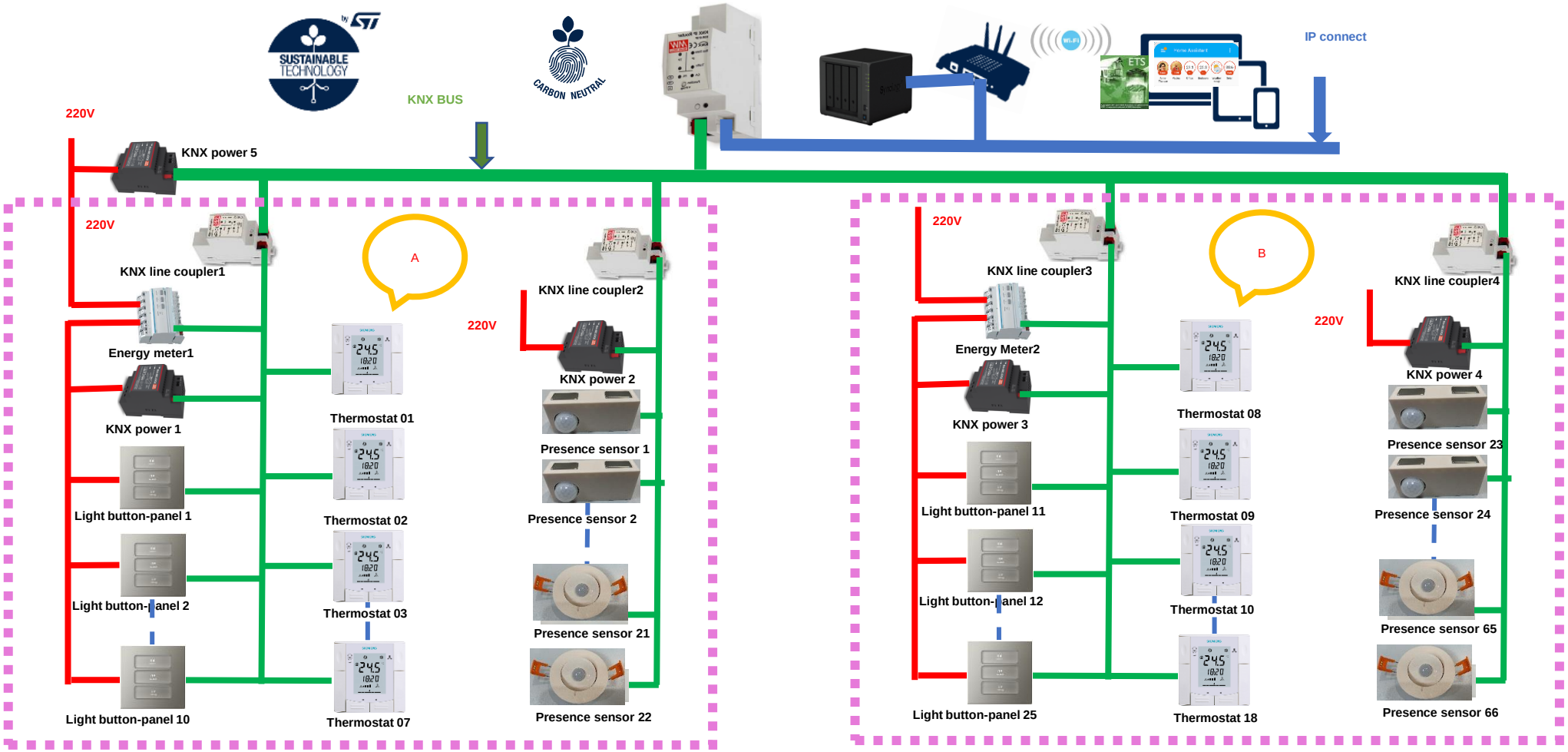
life.augmented

# TCL Office Sustainability Project System




System integrated devices(482):
KNX button panel: 112 KNX presence sensor: 239
thermostat: 105
KNX power: 10 KNX meter: 7 KNX line coupler: 6

# CES Office Sustainability Project System

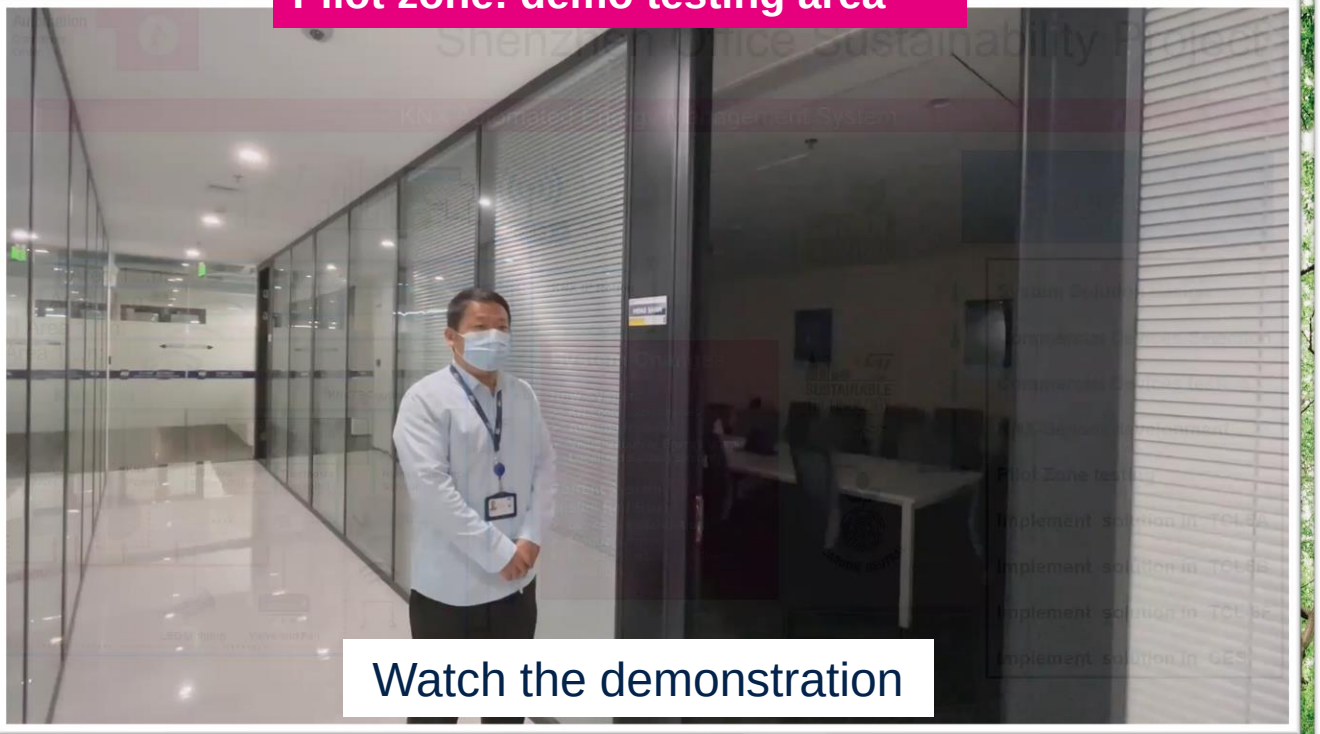



**System integrated devices(123):**
**KNX button panel: 25 KNX presence sensor: 66 thermostat: 18**
**KNX power: 5 KNX meter: 2 KNX line coupler: 4**

Automation
Competence
Center

# Automation CC
# Shenzhen Office Sustainability Project

## Pilot zone: demo testing area



Watch the demonstration

## Pilot zone: 3D view setup


Demonstrate ST tech to customers While saving energy

**~140**
Average Shenzhen office electricity fee(K$/yr)

**~70**
Project initial investment cost TCL+CES (K$)

**~10 hrs**
Automatic reduction per day

**~20-50%**
Cost saving target per year

**~2Y**
Return of initial investment (Years)

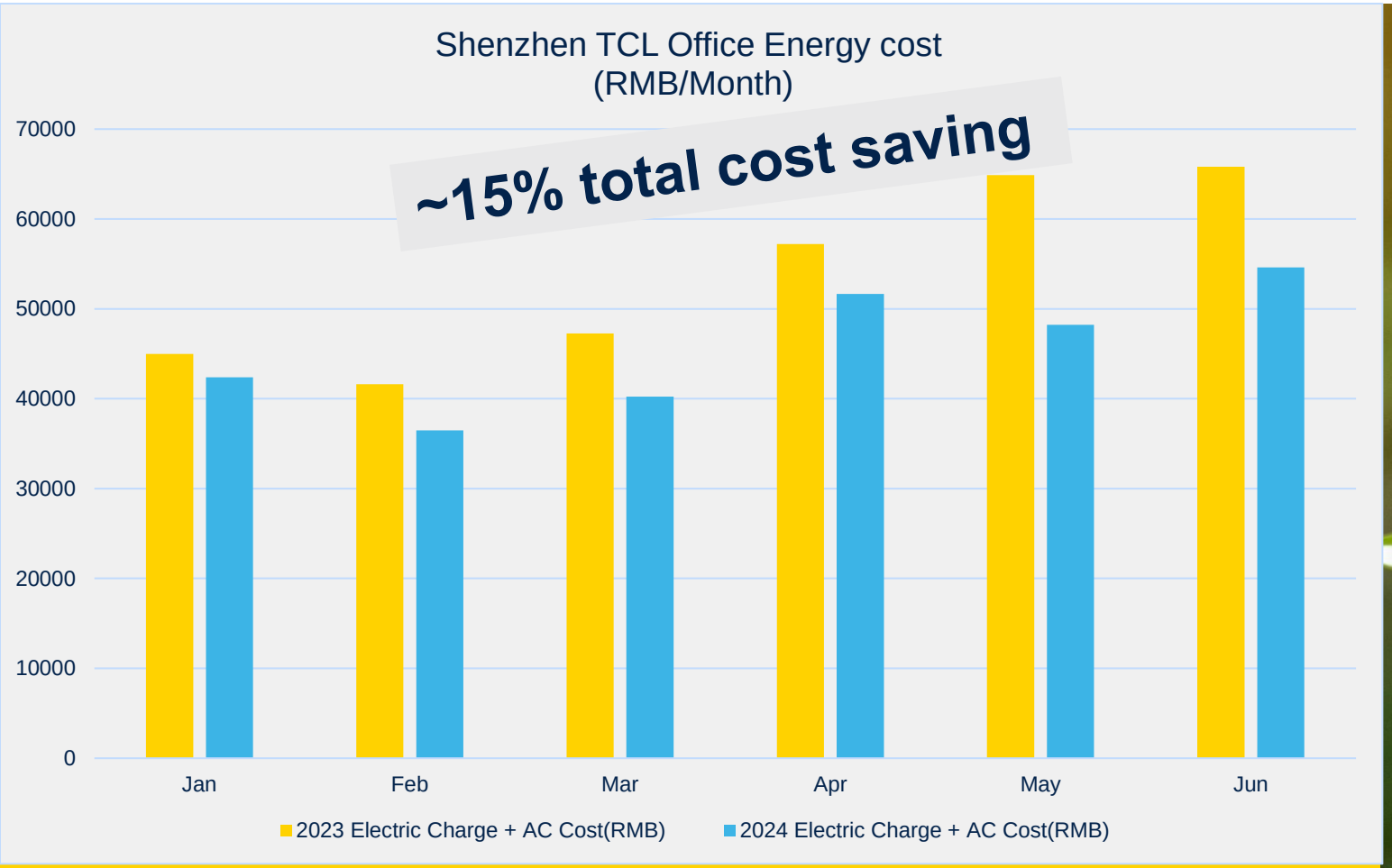
life.augmented

STM32 BlueNRG Flight Sense ST PROTECT SPIRIT ST Op Amps STKNX TMOS

Automation Competence Center

KNX ENERGY MANAGEMENT

# Shenzhen Office Sustainability Project
# Electric charge & AC cost

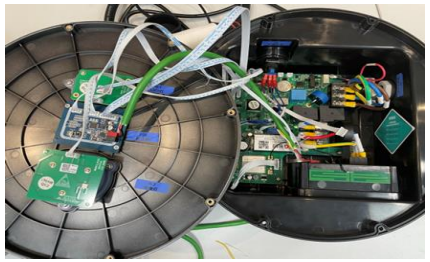




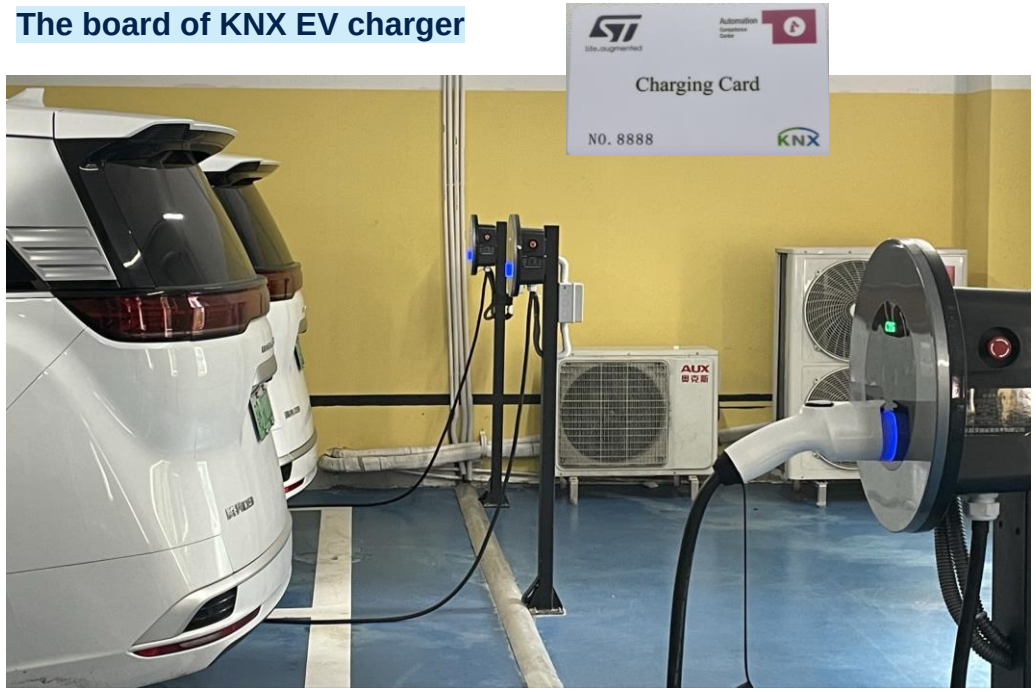
- **The energy cost includes electric charge and air conditioner cost.**
- **This KNX solution project was launched in Jan 2024**

life.augmented

# KNX EV Chargers Are Implemented On TCL parking

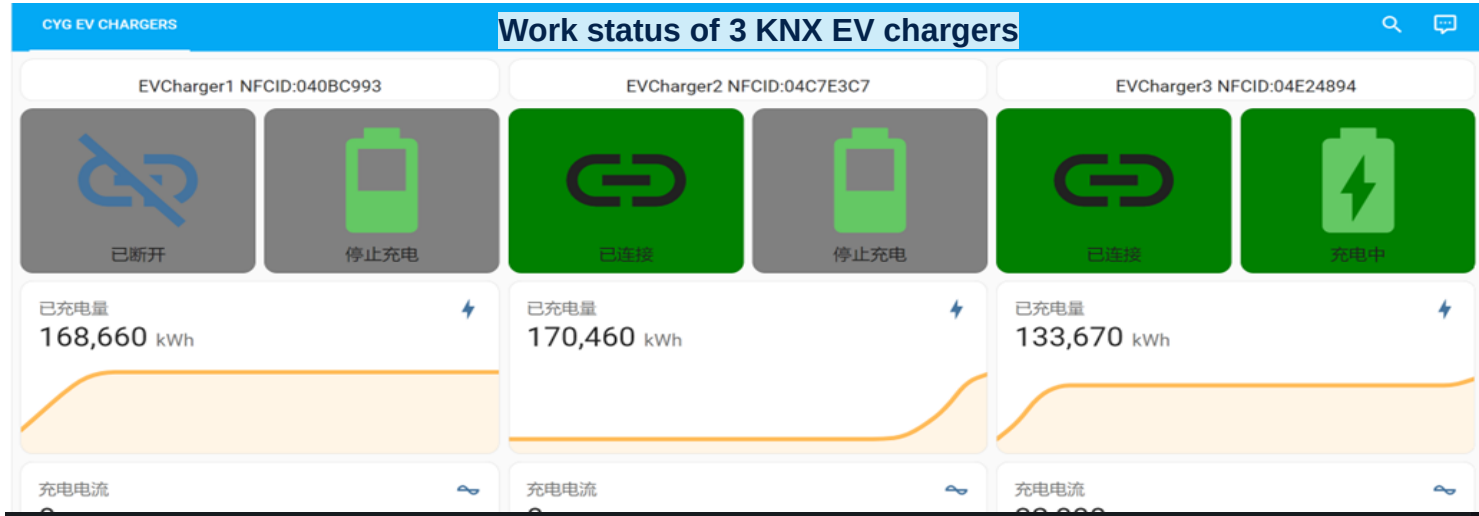


The board of KNX EV charger

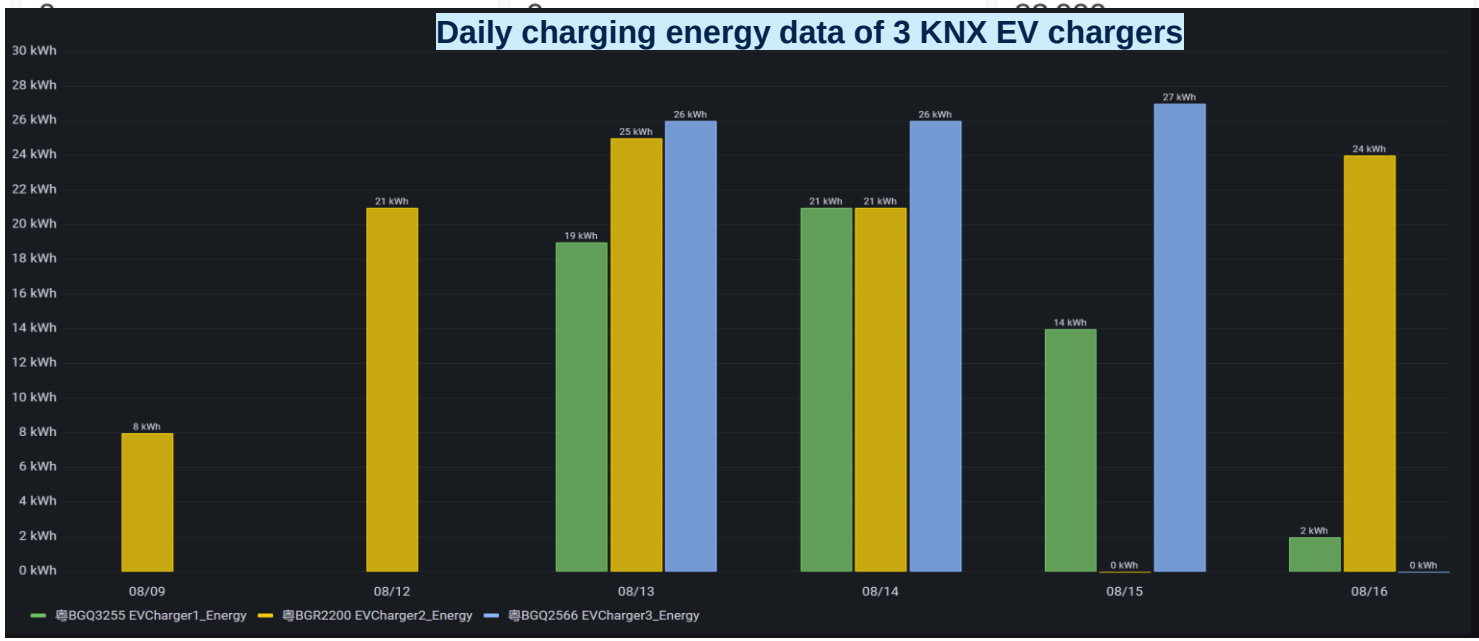



3 KNX EV chargers are working in TCL parking

Work status of 3 KNX EV chargers




Daily charging energy data of 3 KNX EV chargers




life.augmented

# KNX Examples


Guiyang Metro Transportation- Line 2


Beijing Daxing Airport

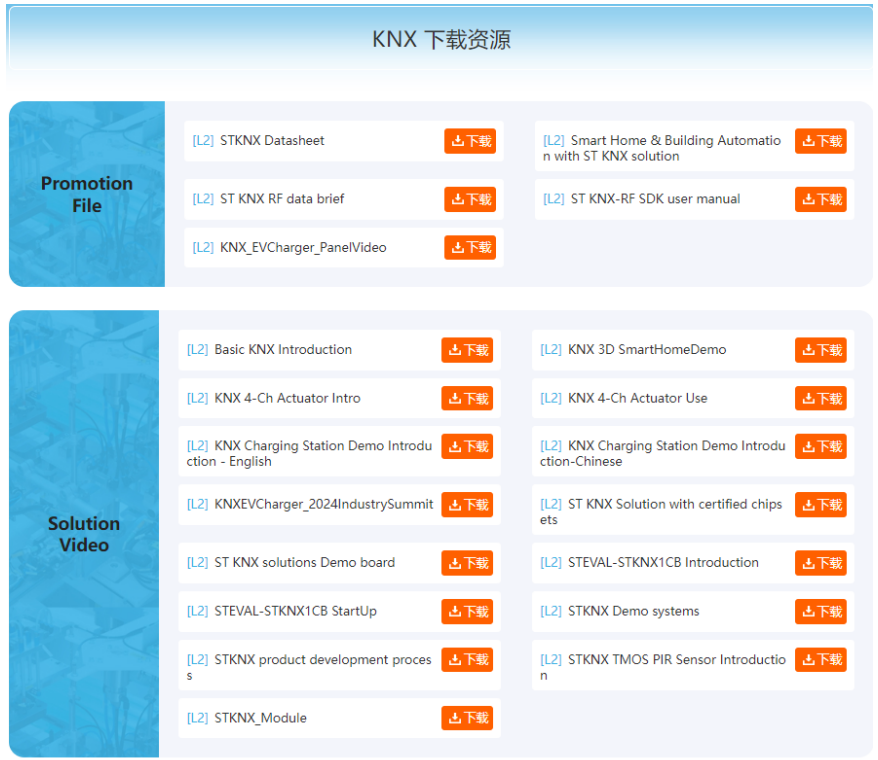

Shenzhen Longhua Jinmao House


Beijing MAHA Luxury House

Source: KNX Awards 2020 Nominees KNX Association [Official website]

# Go-to-market Online Resources

https://st-download.21ic.com/knx
https://www.stmcu.com.cn/embeddedsoftware/3081




KNX 下载资源 - ST下载频道 (21ic.com)


基于STM32G070CBT6+STKNX+STISO621+L6983N33+FreeRTOS操作系统的KNX终端设备开发评估套件 | STMCU中文官网

life.augmented

Automation Competence Center

KNX

微信搜一搜

意法半导体PDSA

# 21ic Training Center - Home Building Automation

https://www.21ic.com/stpower/training_center/


ST KNX solution contributes to the sustainable development target


Home and building automation –Internet of Everything


ST KNX-RF solutions


Automation systems


How to quickly develop a KNX product based on ST KNX and STM32G0 MCU


STKNX solution for home building automation


ST KNX technology empowers smart home/building automation solutions


Home & building automation Connectivity and sensors solutions

life.augmented

Industrial Summit
download center

ST Power & SPIN
microsite (CN Only)

life.augmented

# Our technology starts with You

Find out more at www.st.com



life.augmented