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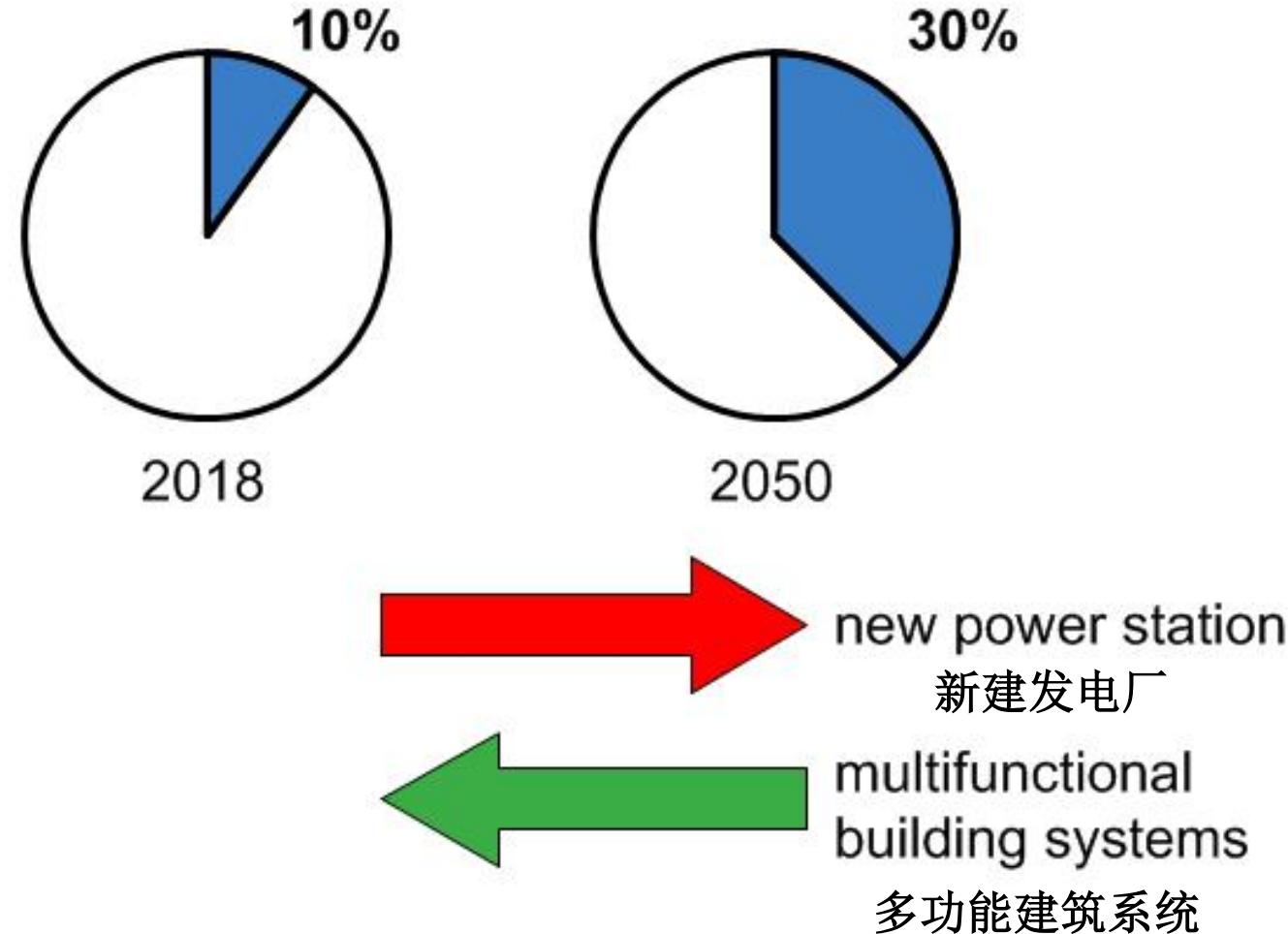
**Multifunctional precast concrete elements – More than heating and cooling
(integrated)**

多功能预制品 混凝土构件 不只是供暖和制冷（集成）

Harmful to the environment: Air conditioning consuming gigantic amounts of electricity
对环境有害：空调的耗电量巨大



Electric power consumption 耗电量占比



Development of building ceilings: Conventional ceiling construction with beam ribs – first construction by F. Hennebique (ca. 1895)

建筑天花板的发展之路：约1895年，F. Hennebique设计了首个传统的带肋梁天花板结构



Development of building ceilings – first flat slab construction

with column head Robert Maillart / Schweiz (1910)

建筑天花板的发展之路：1910年， Robert Maillart于瑞士设计了首个带柱头的平板结构



Actual slab system for building construction: tradional

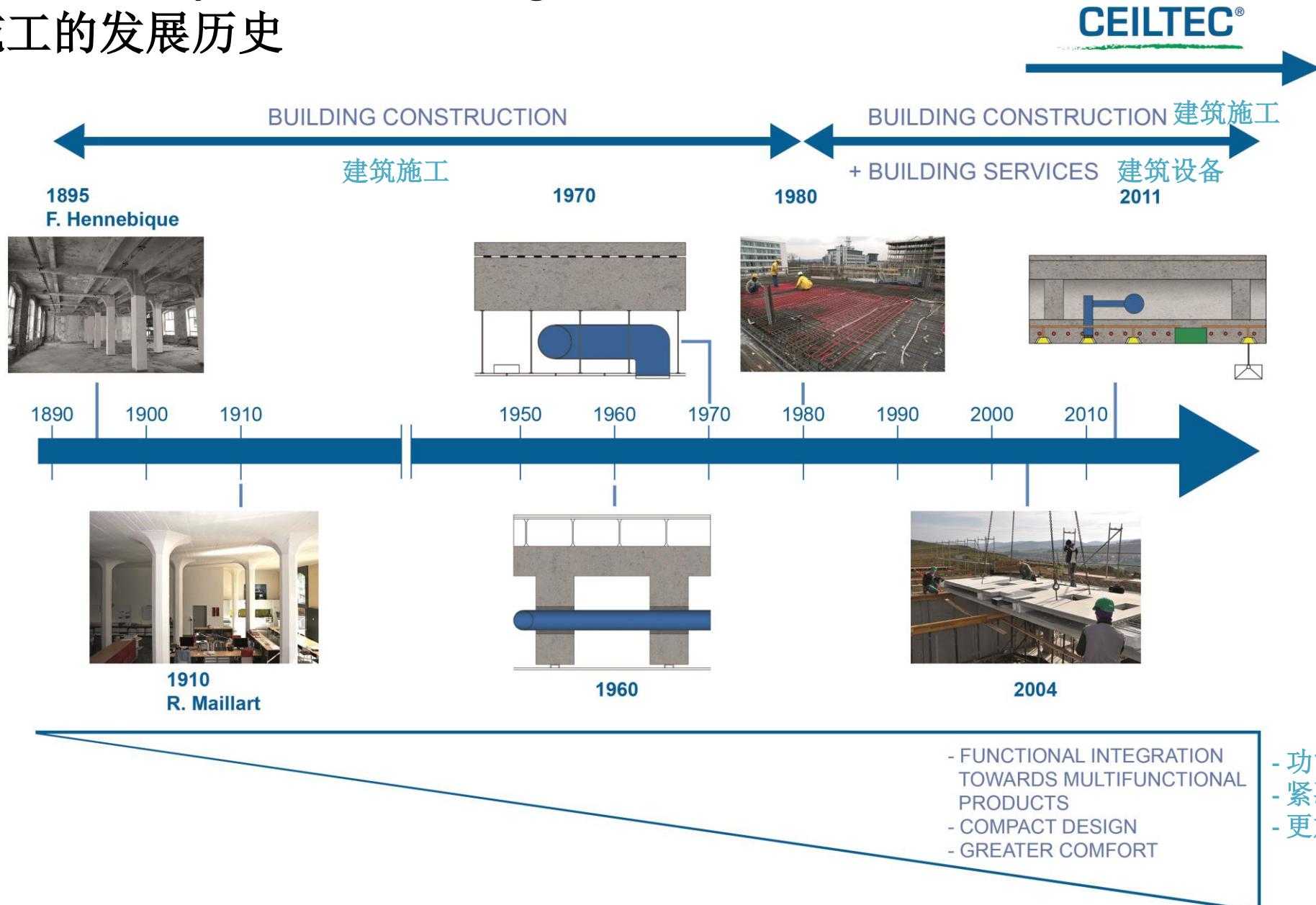
beams and installation between the beams

建筑结构的实际楼板系统：传统梁以及梁间结构



History of development for building construction

建筑施工的发展历史

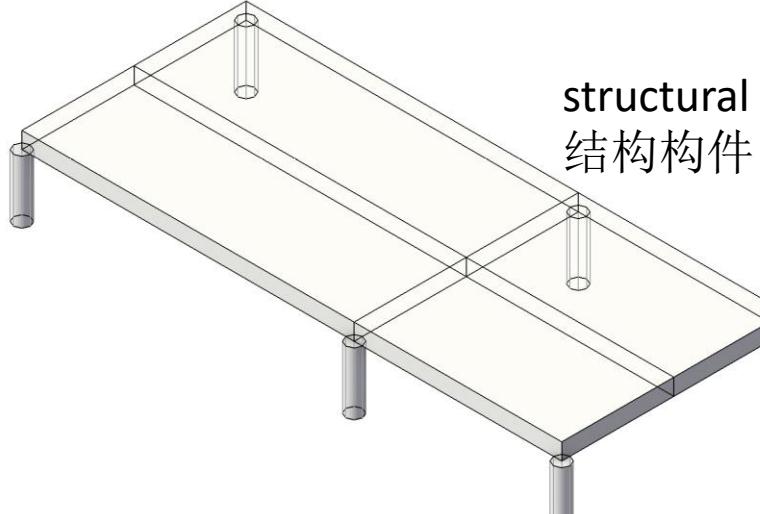


- 功能集成到多功能产品
 - 紧凑型设计
 - 更加舒适

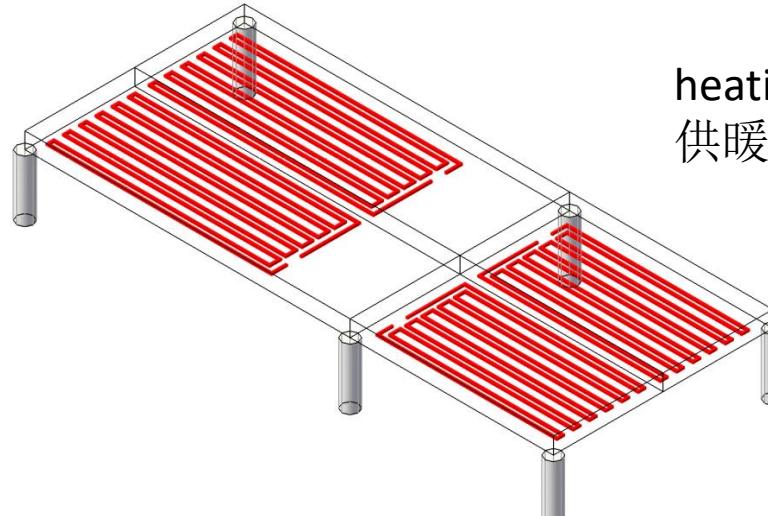
New approach: value innovation

More than a structural element

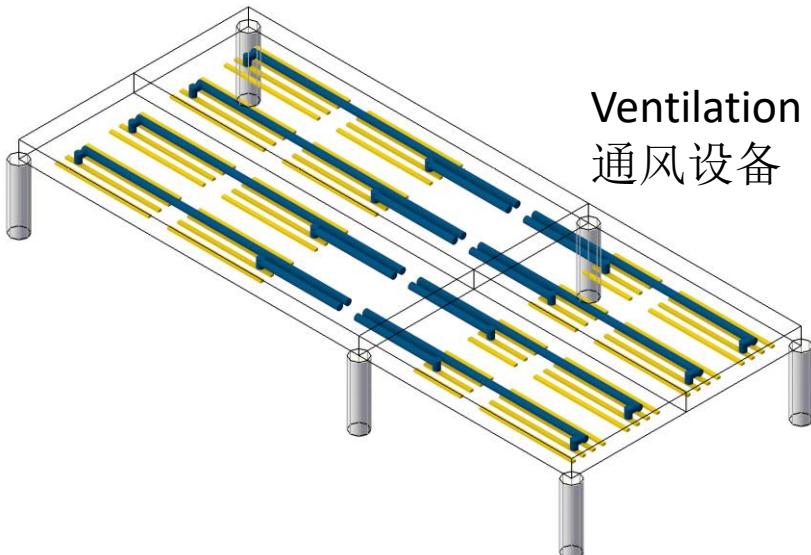
新方法：价值创新
不只是结构构件



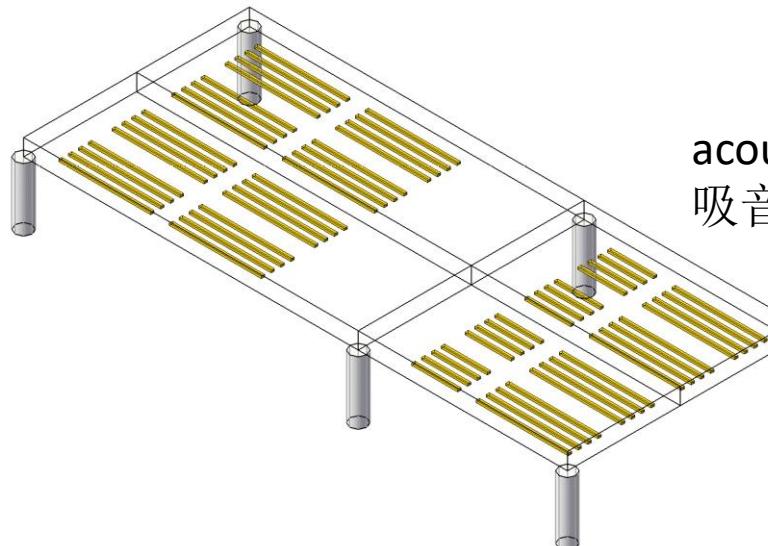
structural element
结构构件



heating/cooling
供暖/制冷



Ventilation
通风设备



acoustic absorber
吸音装置

Precast elements: optimum in light weight and just used for large spans

预制构件：重量轻，仅适用于大跨度结构



Precast elements: structural elements with prestressing

预制构件：具有预应力的结构部件

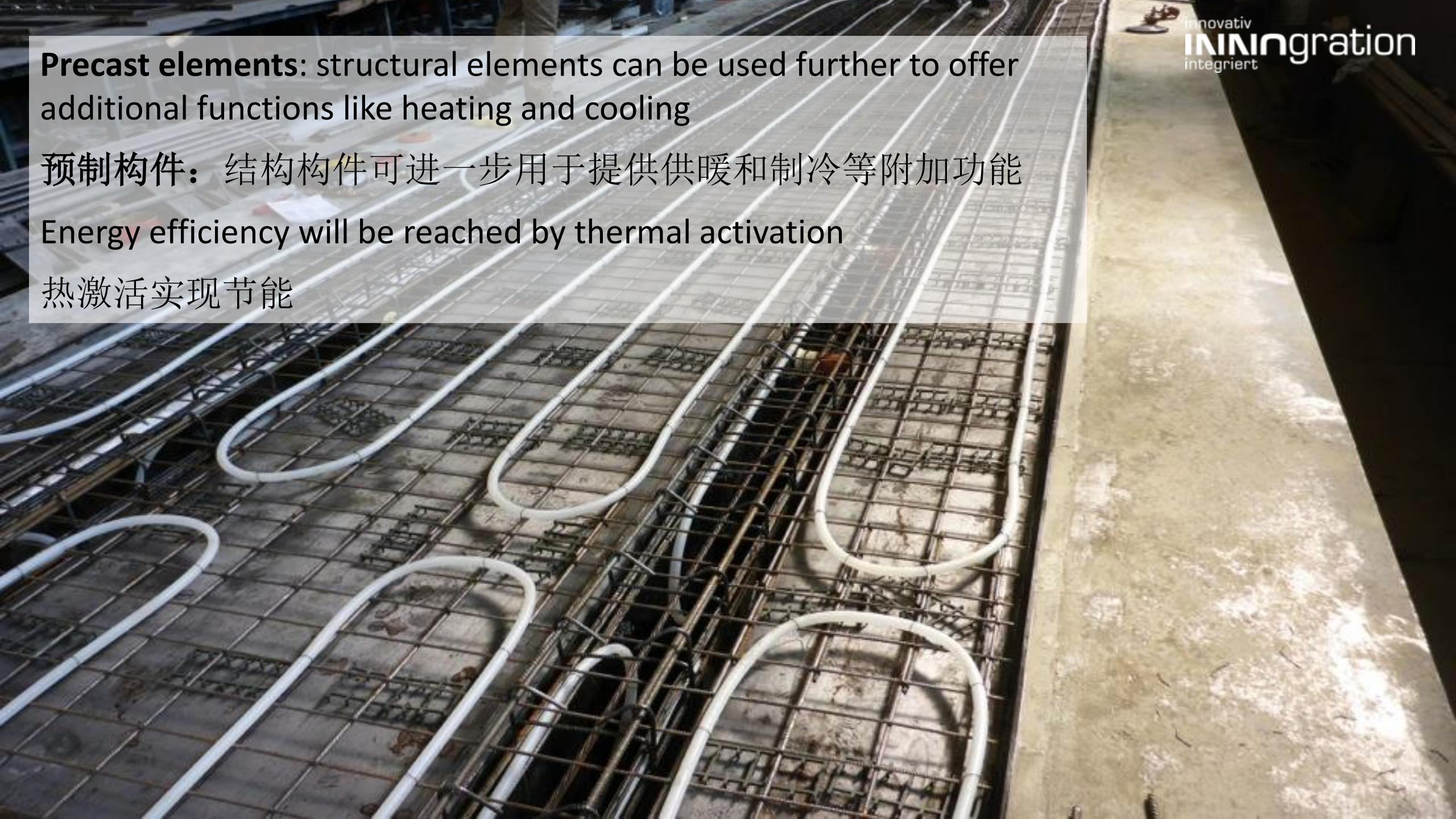


Precast elements: structural elements can be used further to offer additional functions like heating and cooling

预制构件：结构构件可进一步用于提供供暖和制冷等附加功能

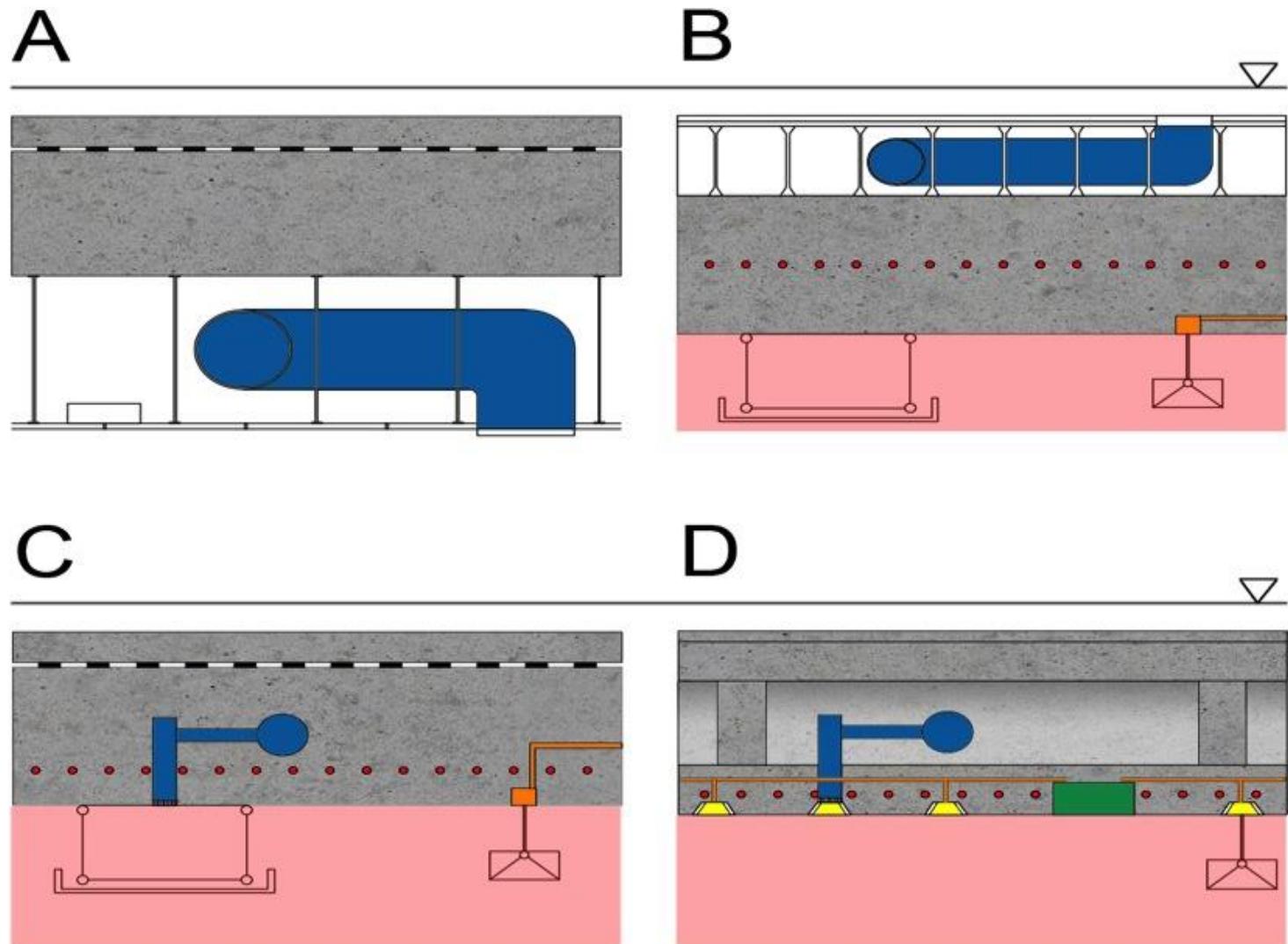
Energy efficiency will be reached by thermal activation

热激活实现节能

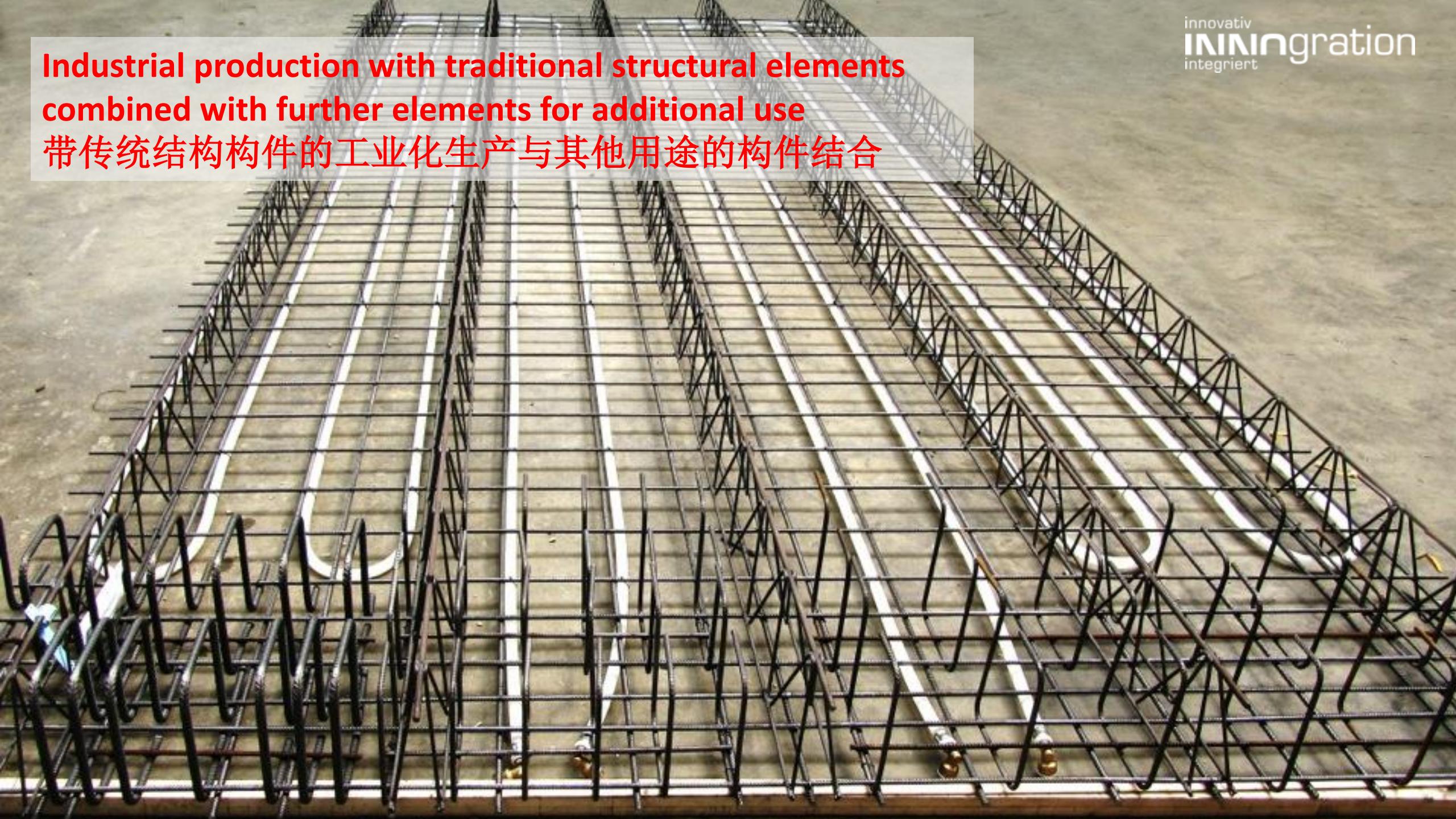


Where to install the elements for building service when thermal activation is used within the cross-section?

当在截面内使用热激活时
在哪里安装构建服务的构件？



Industrial production with traditional structural elements combined with further elements for additional use
带传统结构构件的工业化生产与其他用途的构件结合



Plant production: more than a simply reinforcement mesh
工厂生产：不只是简单的钢筋网片

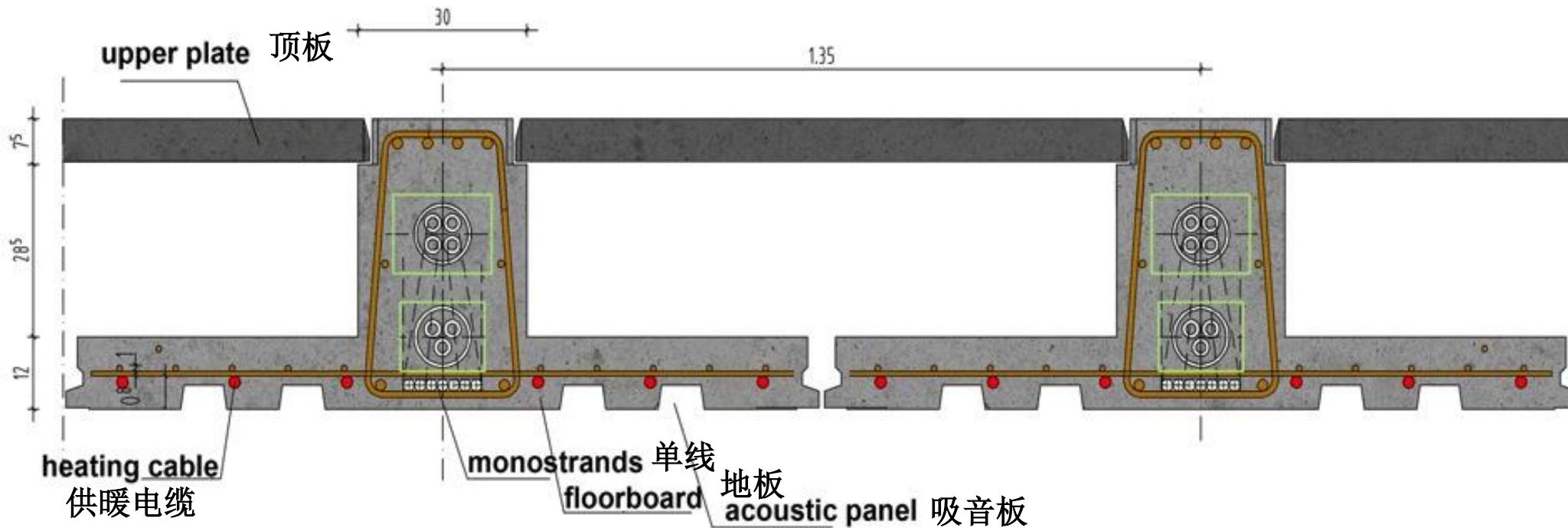


New development due to energy saving reasons:

节能带来新发展:

- sandwich construction = less material / save resources 夹层结构=减少材料/节省资源
- new possibilities (integration of technical building equipment and construction) 新的可能（技术建筑设备和结构的一体化）
- thermoactive material performance: heating and cooling 热活性材料性能：供暖和制冷

Cross-section 截面



Sandwich cross-section for slabs with large span

Integration of building service (HVACR) within the shallow cavity

大跨度板夹层截面

浅槽内集成建筑设备（暖通空调与制冷）



Structural elements combined with additional elements

Prestressing devices and tubes for heating/cooling

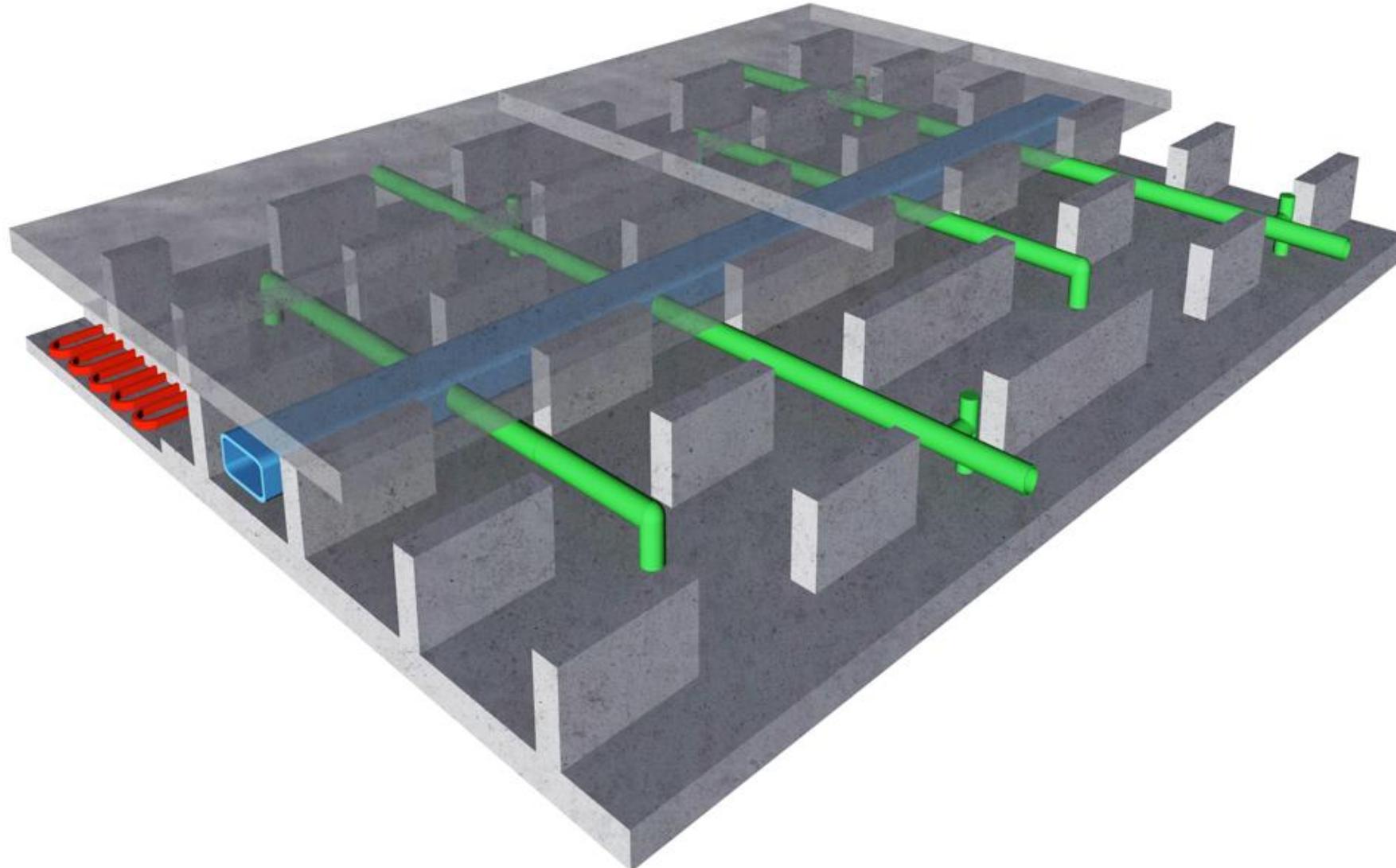
结构构件与其他构件相结合

预应力装置和供暖/制冷管



Shallow cavity and large opening in the load bearing ribs allows tubes and pipes to be placed in each direction

承重墙中的浅槽和大开孔允许往各方向放置管道和管线



Composite structure for large openings: steel plate incorporated as reinforcement within the girder and additionally reinforced by prestressing steel

大开口复合结构：大梁内部配筋，并通过预应力钢构进一步加固



Structural elements with multiple options for the installation of building service (HVACR) devices Prestressing devices and tubes for heating/cooling

带多种建筑设备（暖通空调与制冷）装置安装方案的结构构件
供暖/制冷用预应力设备和管道



Precast elements: more than structural concrete but spiked with all kinds of pipes, tubes and terminal devices for the building service

预制构件: 不只是结构混凝土，还集成了建筑设备所需的各种管道、管路和末端装置



Precast concrete elements: all building service elements are installed within the precast plant and connected on site

预制混凝土构件: 所有建筑服务设施构件均在预制工厂内安装并现场连接



Service lines, pipes, tubes are integrated in the precast factory

大跨度板夹层截面

在预制工厂内集成服务管线、管道、管材



Prefabricated slab elements with large tubes for ventilation

Pipes are integrated in the precast factory and connected on site

带大型通风管道的预制板构件

管道在预制工厂中集成并在现场连接



**Shallow cavity between the load bearing ribs
will be used for installation of building service elements**
承重墙之间的浅槽将用于安装建筑服务设施构件



Shallow cavity between the load bearing ribs and openings
will be used for installation of integrated service lines
承重墙和开口之间的浅槽将用于安装集成服务管线



Connecting lines on side together to complete the functions for building services
连接管线，完成建筑服务设施功能



Shallow cavity between the load bearing ribs is used for the preassembled heat distributor in order to organize heating and cooling with thermoactive component system

承重墙之间的浅槽用于放置预装散热器，以便通过热活性构件系统进行供暖和制冷



Strutural slab element combined with addional elements

Shallow formwork to incorporate acoustic panels later
(reverberativ surface)

结构板构件与附加构件相结合

浅模板便于以后加入吸音板（混响表面）

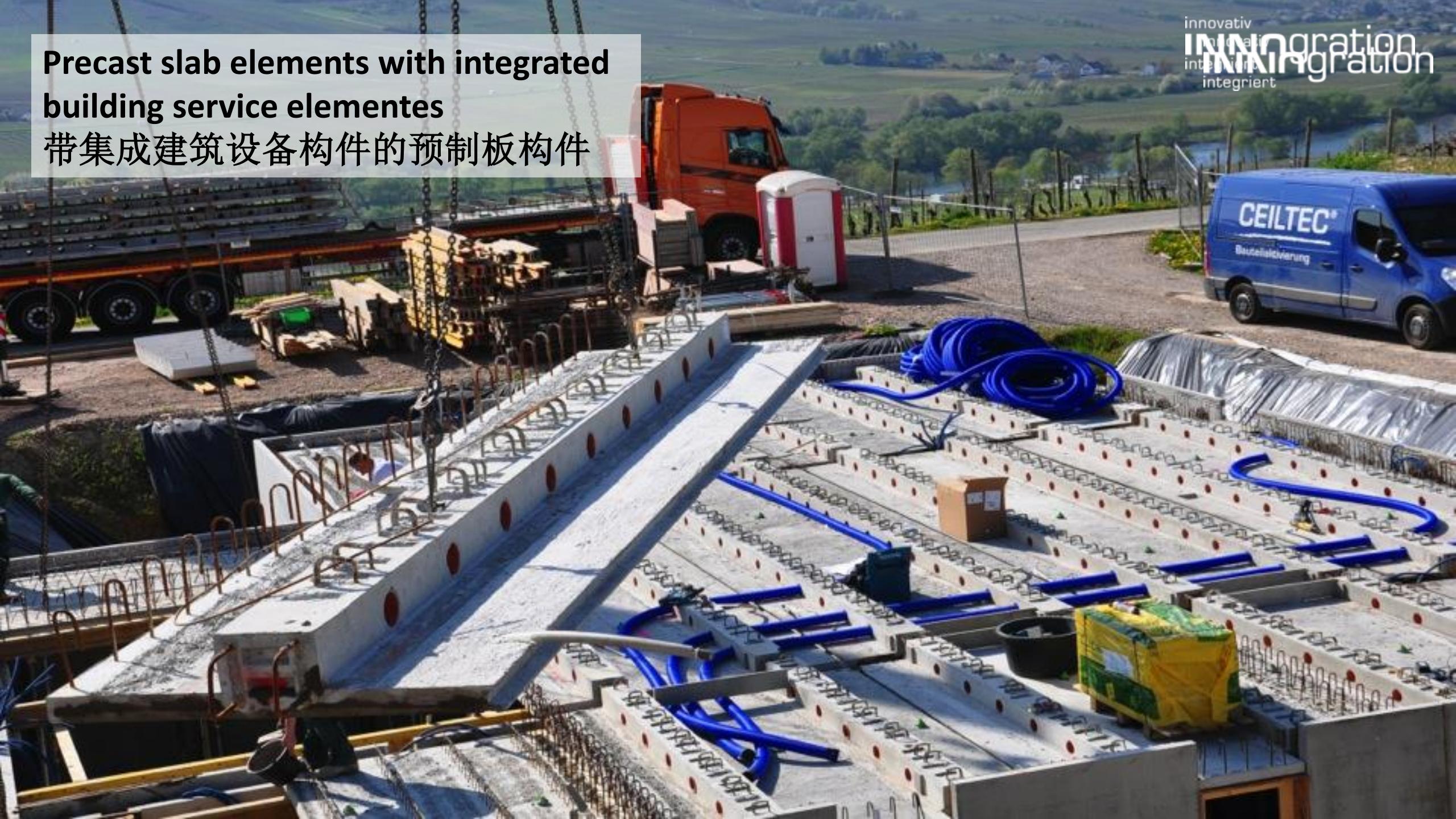


Precast slab element with different installation
devices for multifunctional use

带不同安装装置的预制板构件实现多功能用途



Precast slab elements with integrated building service elements 带集成建筑设备构件的预制板构件

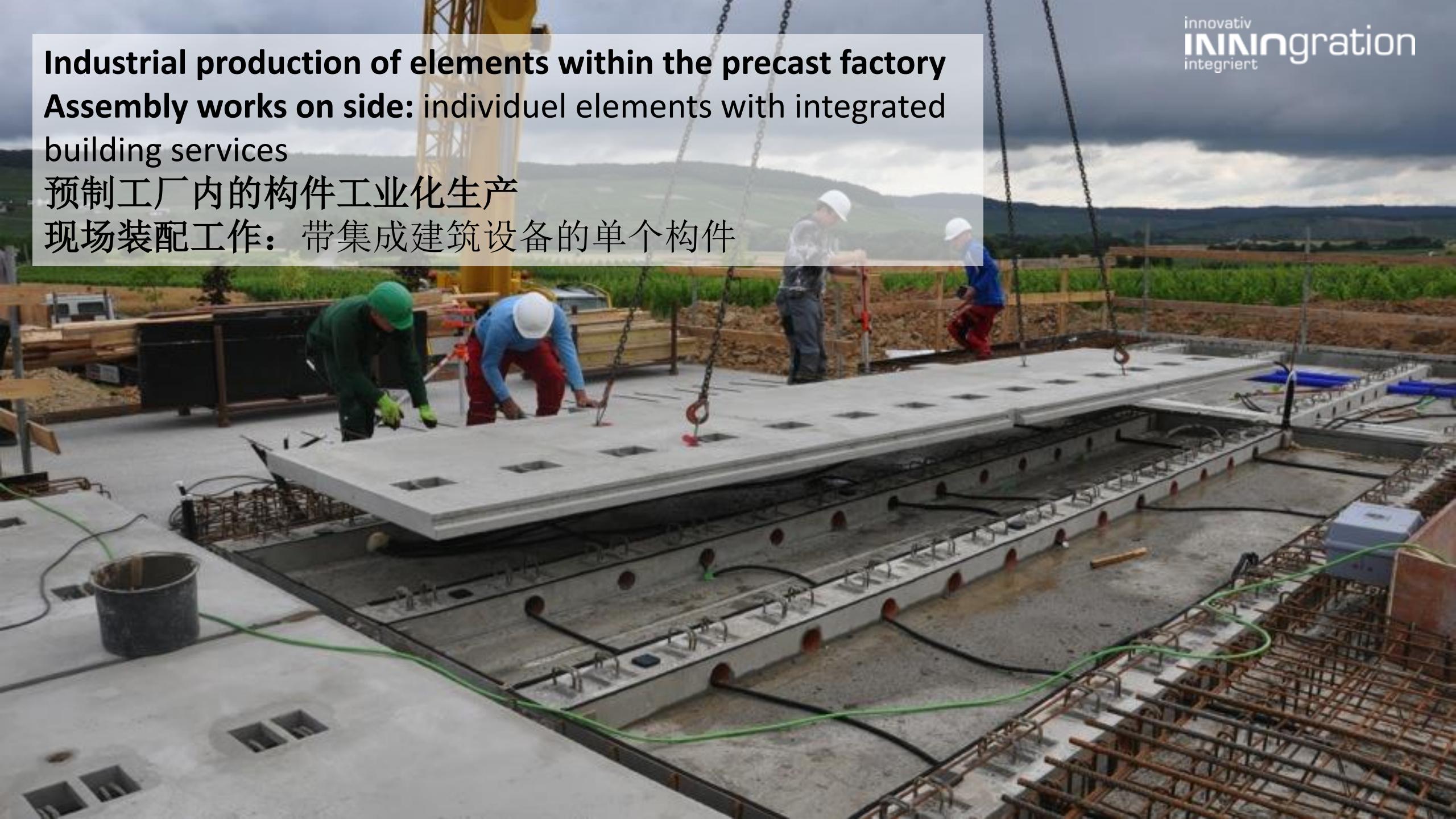


Industrial production of elements within the precast factory

Assembly works on site: individuel elements with integrated building services

预制工厂内的构件工业化生产

现场装配工作：带集成建筑设备的单个构件



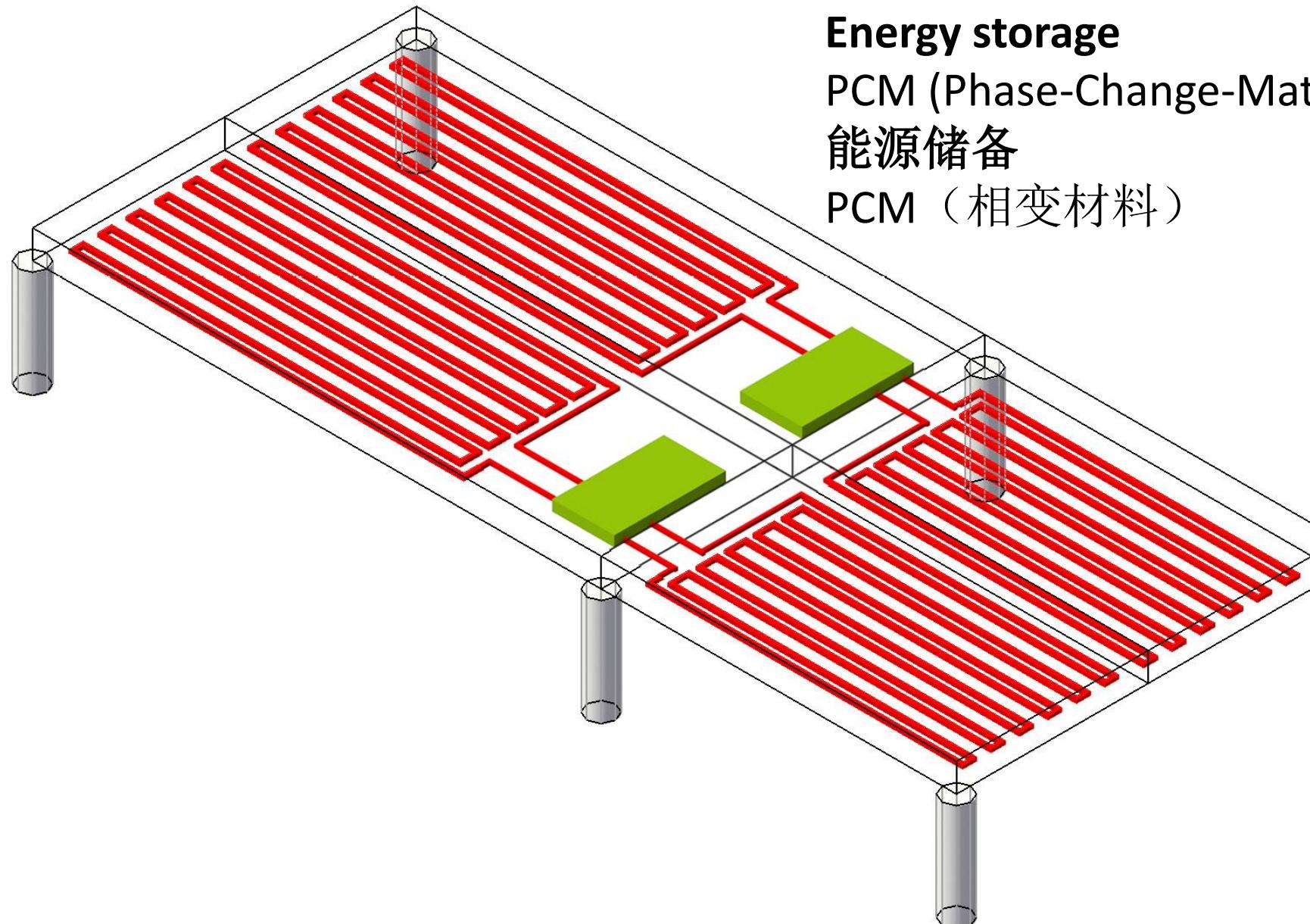
All activities on side: place the lower part of the slab; fulfill the building service lines; place the upper part of the slab

现场所有施工内容：放置底部楼板；完成建筑设备管线施工；放置顶部楼板

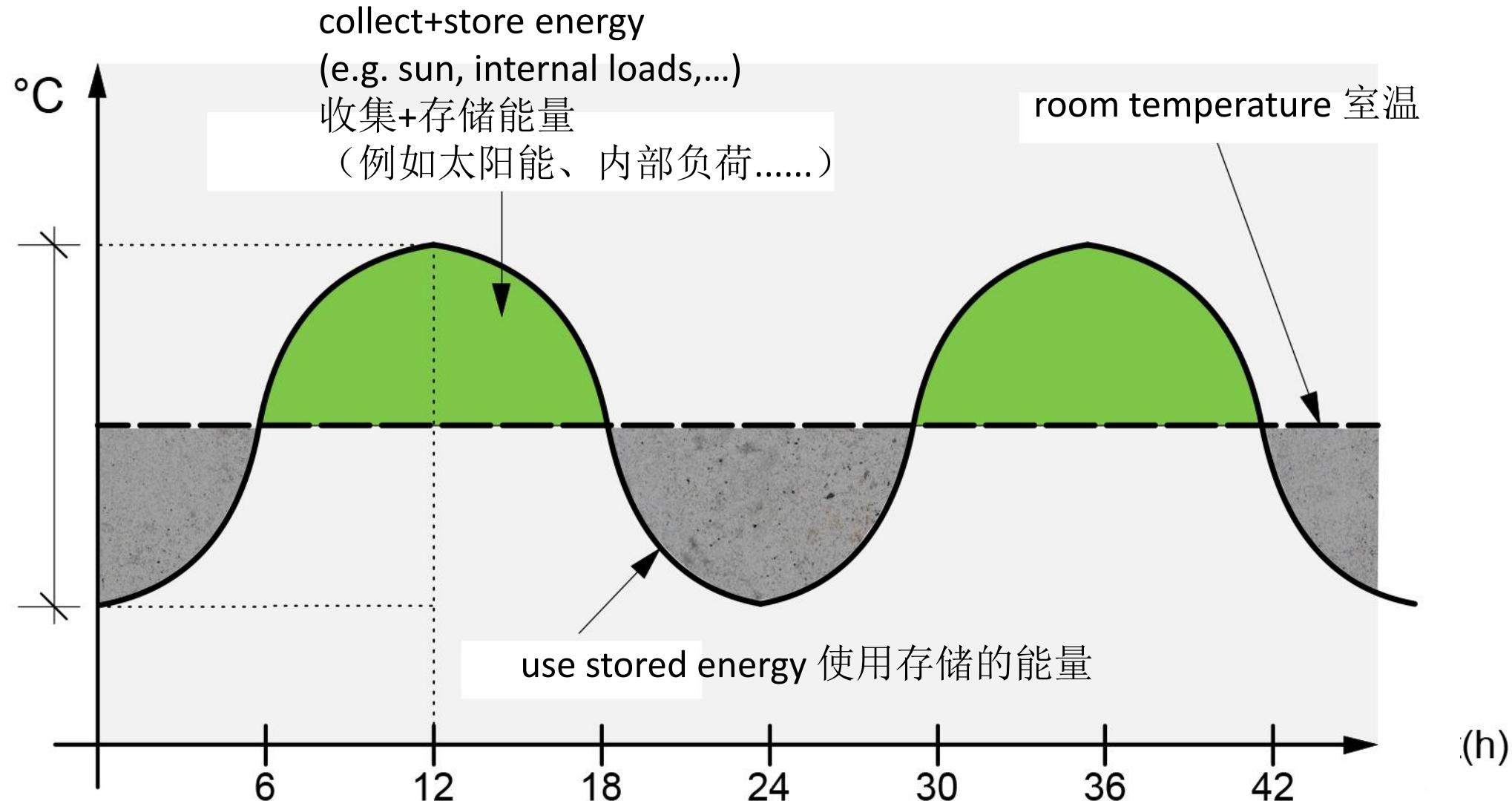


New approach: more value innovation

新方法：更多价值创新

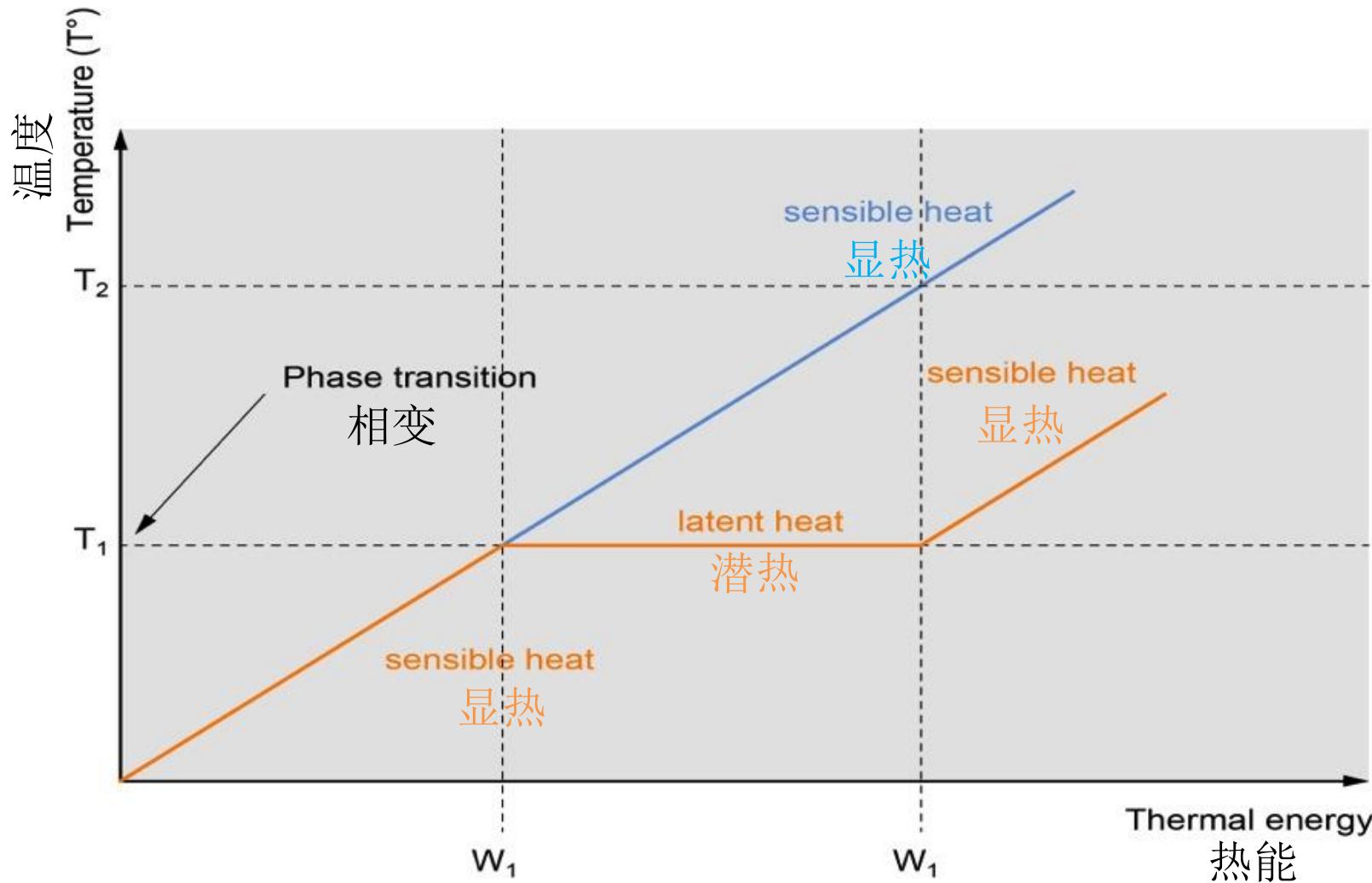


Temperature-running 不同温度下的运行情况



Saving thermal energy with latent heat in boxes, which are installed within the cavity of the slab with sandwich cross-section

利用安装在夹层截面板槽内箱体中的潜在热量来节省热能



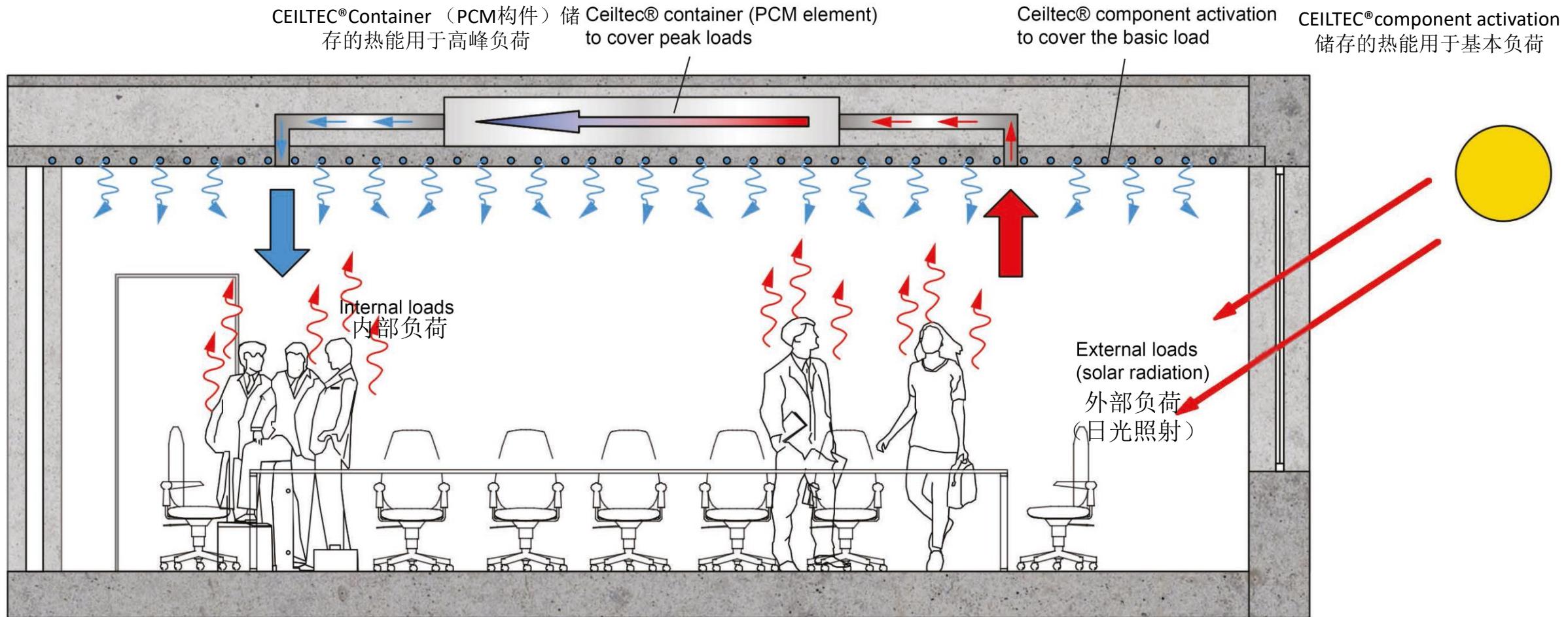
Separate thermal storage device, to cover for cooling performance, heating performance Flexible input wheather by air or by water conducted pipes (CEILTEC® PCM-Container)

独立的蓄热装置，根据气候状况灵活将空气或水导入管道
(CEILTEC®PCM-Container) 进行供暖或制冷



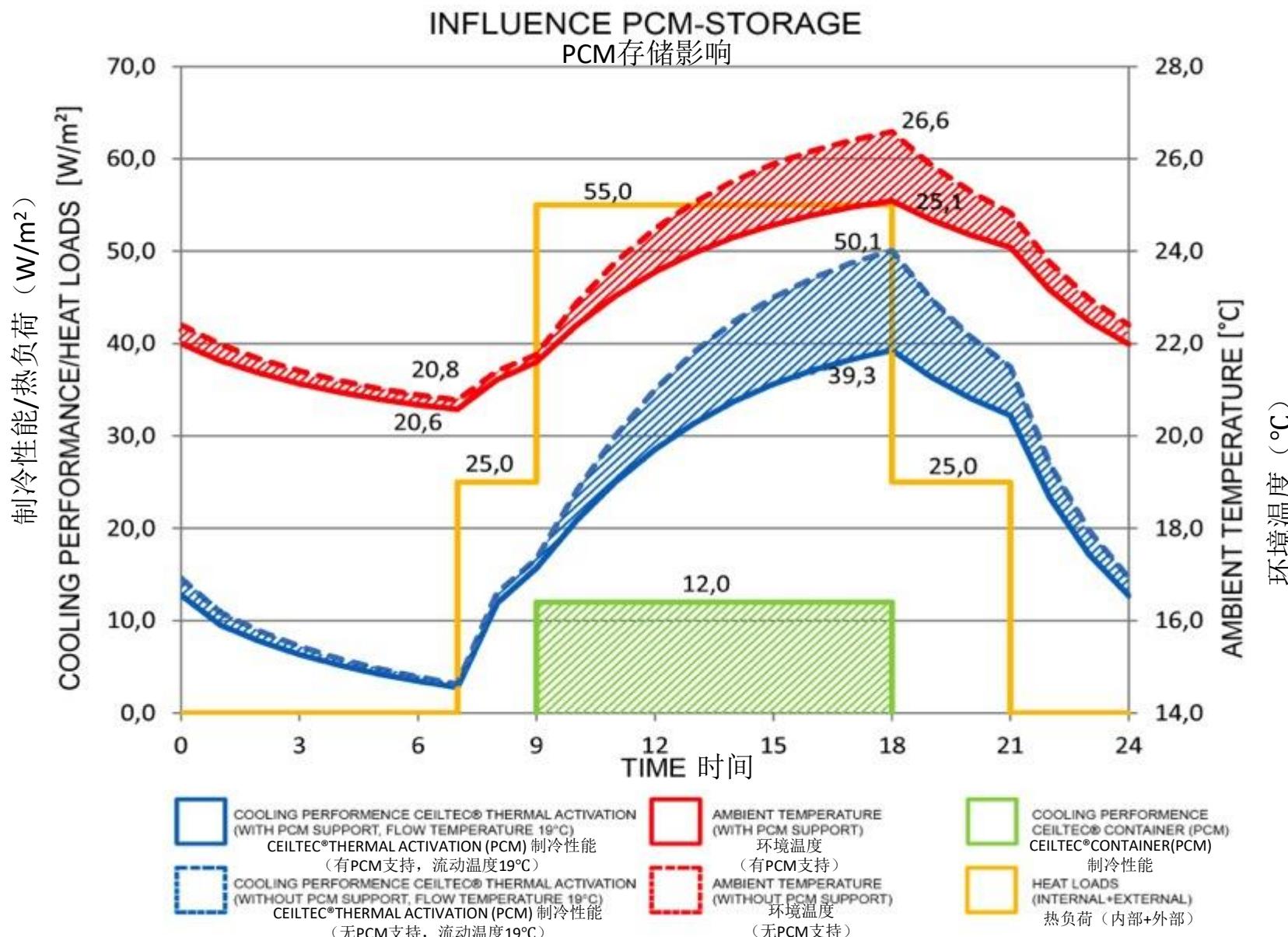
Stored thermal energy will be used during peak load time

存储的热能将在高峰负荷时段使用



Advantages with additional thermal storage elements

附加蓄热构件的优势

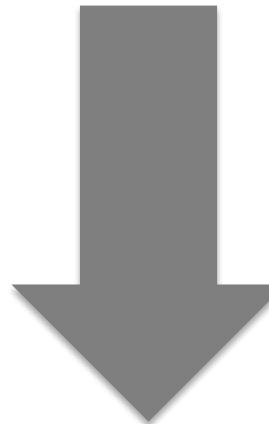




Projects 项目

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Member of:
成员:



Mitglied der
DGNB
Deutsche Gesellschaft für Nachhaltiges Bauen
German Sustainable Building Council

Labels 标识



Bürogebäude Prosis, Ingolstadt



Kreativpark, Karlsruhe



Kreativpark, Karlsruhe



Kreativpark, Karlsruhe



Hauptverwaltung Paulaner, München



Hauptverwaltung Paulaner, München



**Self-sufficient energy supply will only be fulfilled with
multifunctional slab systems and different storage devices**
(structural concrete, water tank, PCM-device)

只有多功能楼板系统和储存装置（结构混凝土、水箱、
PCM装置）结合才能实现自给自足的能源供应



Thanks a lot for
your attention!

谢谢！