

2016 Integration of District Heating in a Sustainable Energy System

2016中丹可再生能源系统区域供热研讨会

— Technologies, Markets and Policies

— 技术、市场与政策

主办 Hosted by

中丹科研教育中心 Sino-Danish Center

国际铜业协会 International Copper Association(ICA)

协办 Sponsored by

北京四季沐歌太阳能技术集团有限公司 Beijing MICOE solar technology group co., LTD

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国际金属太阳能产业联盟 International Metal Solar Industry Alliance (IMSIA)

中国 北京 CHINA Beijing

October 2016





基于第三代分布式能源的区域能源系统

District Energy System Based on Third Generation of
Distributed Energy

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中国城区能源消费特点

Characteristics of energy consumption in
Chinese urban communities

01

第三代分布式能源

The 3rd generation of distributed energy

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高能效的能源微网系统

Micro Energy Net with high performance

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城市化面临的能源挑战 The energy challenges of new urbanization

现代服务业和先进制造业对室内环境的高要求。

The high demands on indoor environment of modern service industry and advanced manufacturing.

工业化时代高温高（电）压高品位需求转变为后工业化时代低温低（电）压低品位建筑环境需求

High-grade, high temperature, high voltage and high pressure energy demand in Industrial era changes to low temperature, low pressure, low voltage and low-grade energy demand in Post-industrial era. Mainly for indoor environmental maintaining.

工业化时代稳定的工艺用能负荷转变为后工业化时代波动的建筑用能负荷

Stable process energy load in the industrial era changes to fluctuant building energy load in the post-industrial era

保障民生的生活能耗增长

Growth of urban life energy demand for protecting the livelihood.

高密度城市形态和低密度可再生能源之间的矛盾

Conflicts between high-density urban form and low-density renewable energy resources.

能源领域垄断机制与能源互联网机制之间的矛盾

Conflicts between highly monopoly and internet-of-energy-based mechanism in the energy sector.

中国城市能源利用特点 Characteristics of energy use in Chinese cities

城市能耗中以传统制造业能耗为主

- The traditional manufacture industry gives first place to urban energy consumption.

以煤为主的高碳能源禀赋

- Coal-based high-carbon energy endowments.

土地和能源利用效率不高

- The efficiency of land and energy use is not so high.

环境承载能力达到或超过极限

- Environmental carrying capacity has reached or exceeded its limit.

极端脆弱的生态

- Extremely fragile ecology.

大城市病加重能源消耗

- Metropolitan disease exacerbation energy consumption.

建筑能耗远低于发达国家

- Building energy consumption is far lower than the developed countries

城镇化新动向 New trend of urbanization (2015:2014)

到2015年底，上海常住人口为2415.27万人，**比2014年底减少了10.41万人**；其中户籍人口增长了3万多人，非户籍常住人口减少了14.77万人。

• By the end of 2015, Shanghai permanent resident population of 24.1527 million, compared with the end of 2014, decreased 0.1041 million.

2015年上海居民用电量同比上升6.7%。但相比2013年还是下降10%左右，低于2011年水平。

• 2015 Shanghai residents electricity consumption rose 6.7%. But compared to 2013, it still down about 10%, lower than the level of 2011.

2015年上海私人汽车增长13.8%。

2015年上海GDP增长6.9%，工业总产值同比下降0.5%。

批发零售中无店铺零售额增长26.9%。网上商店零售额增长31.6%。

• Non-store retail sales rose 26.9%. Online store retail sales rose 31.6%.

不断增长的需求 Growth of demand

长江中下游地区居民采暖的强烈需求

- Strong heating demand of residents in the middle and lower reaches region of the Yangtze River (hot summer and cold winter zone) .

对室内环境品质和健康建筑的关注

- Attention to indoor environmental quality and healthy building.

规模化利用可再生能源

- Large-scale use of renewable energy.

煤改气，煤改电

- Change of energy structure: coal to gas, coal to electricity

三代分布式能源 Three generations of distributed energy

根据国际分布式能源发展历程，可以把分布式能源分为三代。According to the development process of international distributed energy, the distributed energy can be divided into three generations.



第一代是传统的热电联产：单一燃料（煤或天然气）输入、热电输出、单一中心能源站（热电厂模式），发电机规模300MW以下，电力上网，蒸汽或高温水输出，靠近用户；The first generation is the traditional cogeneration: a single fuel (coal or natural gas) input, thermal and electricity output, a single central energy station (thermal power mode), the size of 300MW or less generator, electricity access, steam or hot water output, close to the user;



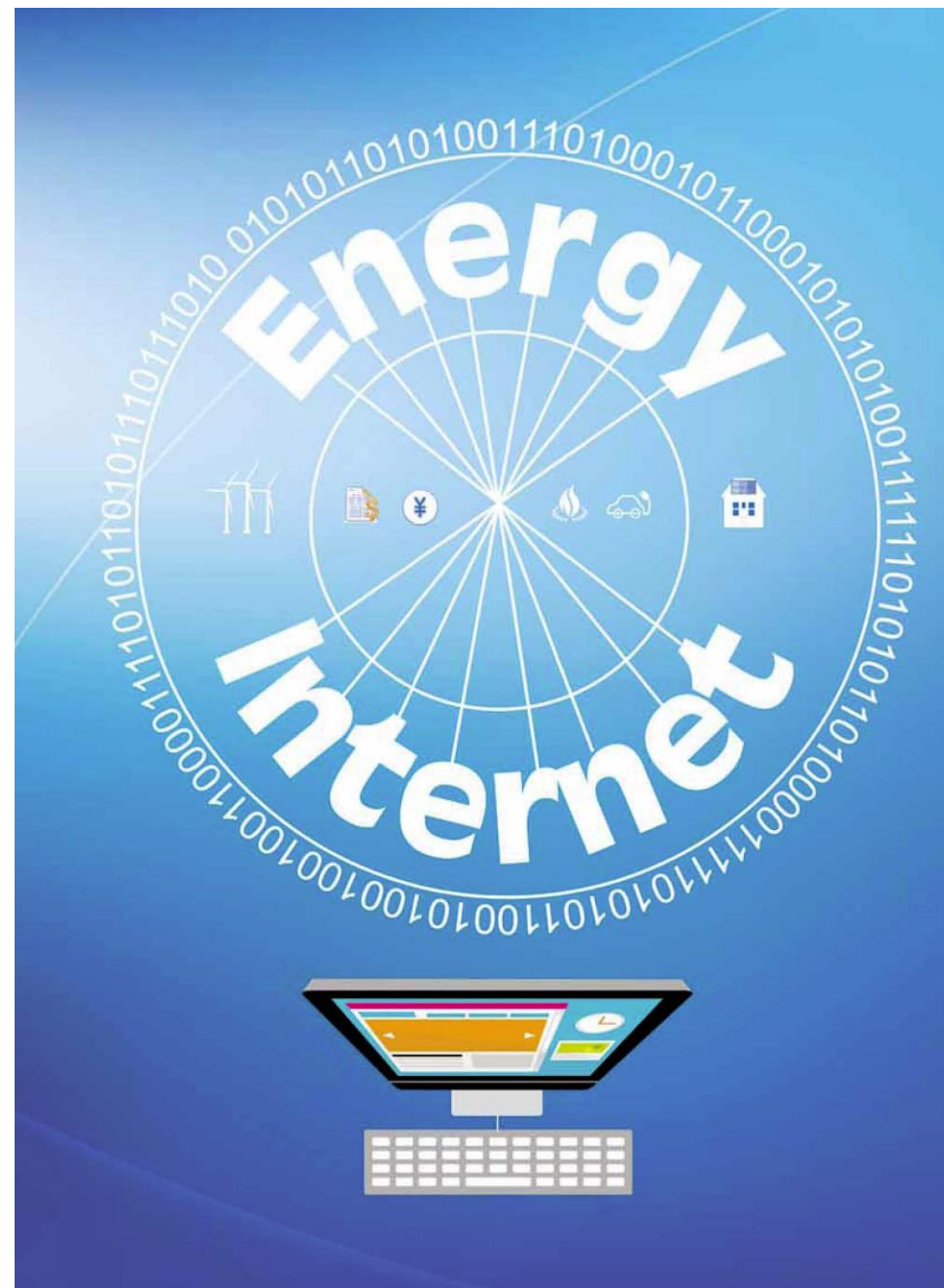
第二代是区域或楼宇的冷热电多联产：即清洁燃料（天然气）输入、多种形式能源（热、电、冷、热水）输出、单一中心能源站（冷热电三联供模式），由于需要供冷，发电机规模在50MW以下，电力并网或上网，热水和冷水输出。在中国受制于消防、建筑和投资的因素，多数新建冷热电三联供都是区域级的，接近用户。The second generation is district or multi-building heating and power generation.

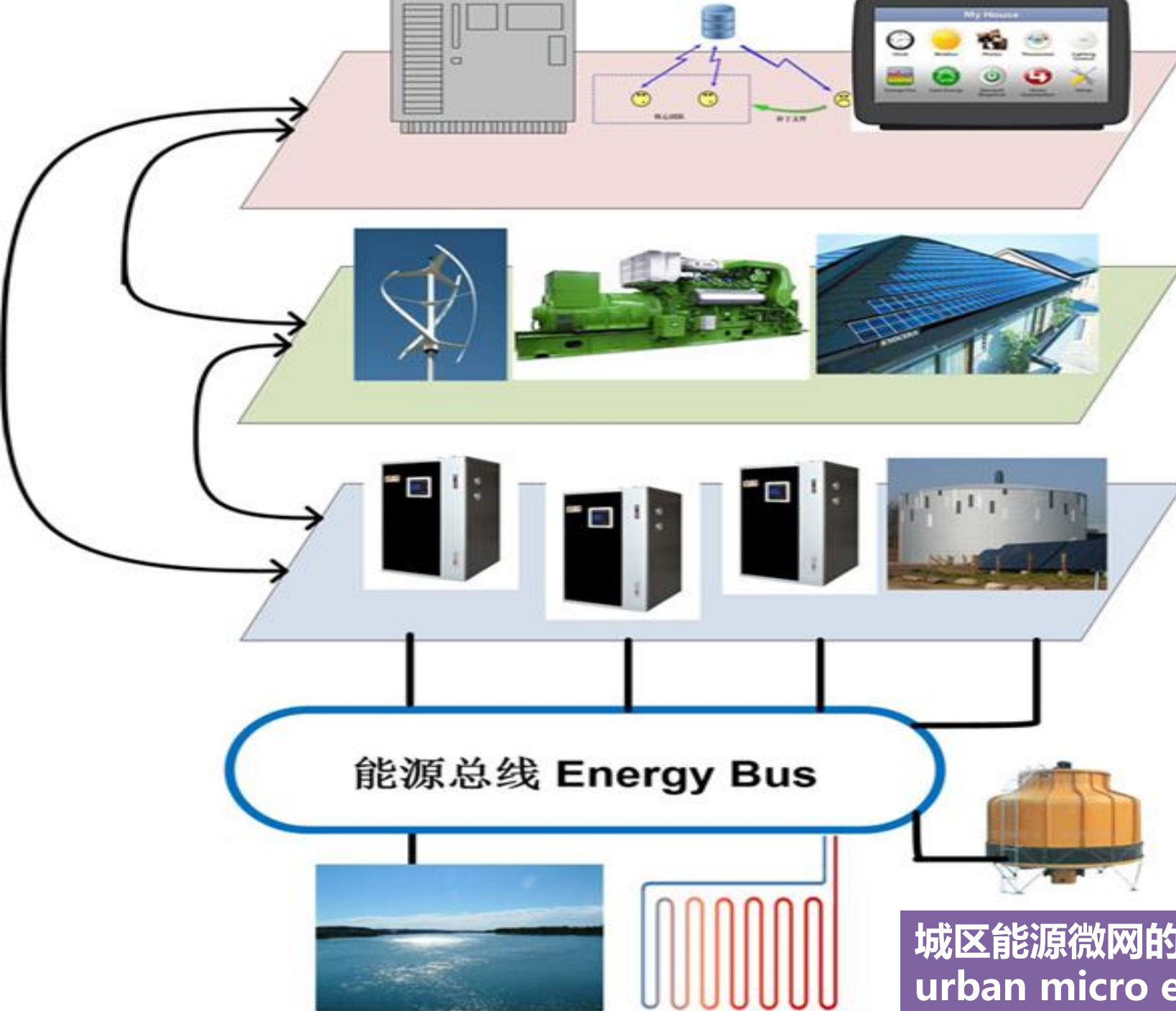


第三代是分布式多能源品种（可再生能源和清洁能源）发电，多种形式能源（热、电、冷、热水）输出，每一幢建筑既产能也用能，形成多个产能节点，通过能源互联网共享资源（能源微网模式），贴近用户。The third generation is a distributed multi-energy sources (renewable energy and clean energy) generation,

第三代分布式能源的主要技术 Major technologies of 3rd generation DES

- 小于1MW的太阳能光伏； PV less than 1MW
- 小于500kW的小型风力发电； Small wind power of less than 500kW
- 固定式燃料电池； Stationary fuel cell
- 小于6MW的天然气发电机组； Natural gas electric generator less than 6MW
- 小于6MW的柴油发电机组。 Diesel electric generator less than 6MW
- 设备设置的灵活性 The flexibility of device settings
- 基于互联网的能源管理 Energy management based on internet





管理层Management Layer

泛在智能能源管理系统
Ubiquitous Smart Energy
Management System

核心层Core Layer

多源现场发电系统
Multi Source On-site Generation
System

框架层Frame Layer

分布式水源热泵系统和蓄热装置
Distributed Water-Source Heat
Pump System & Heat Storage

能源总线 Energy Bus

热源/热汇 Heat Source/Sink

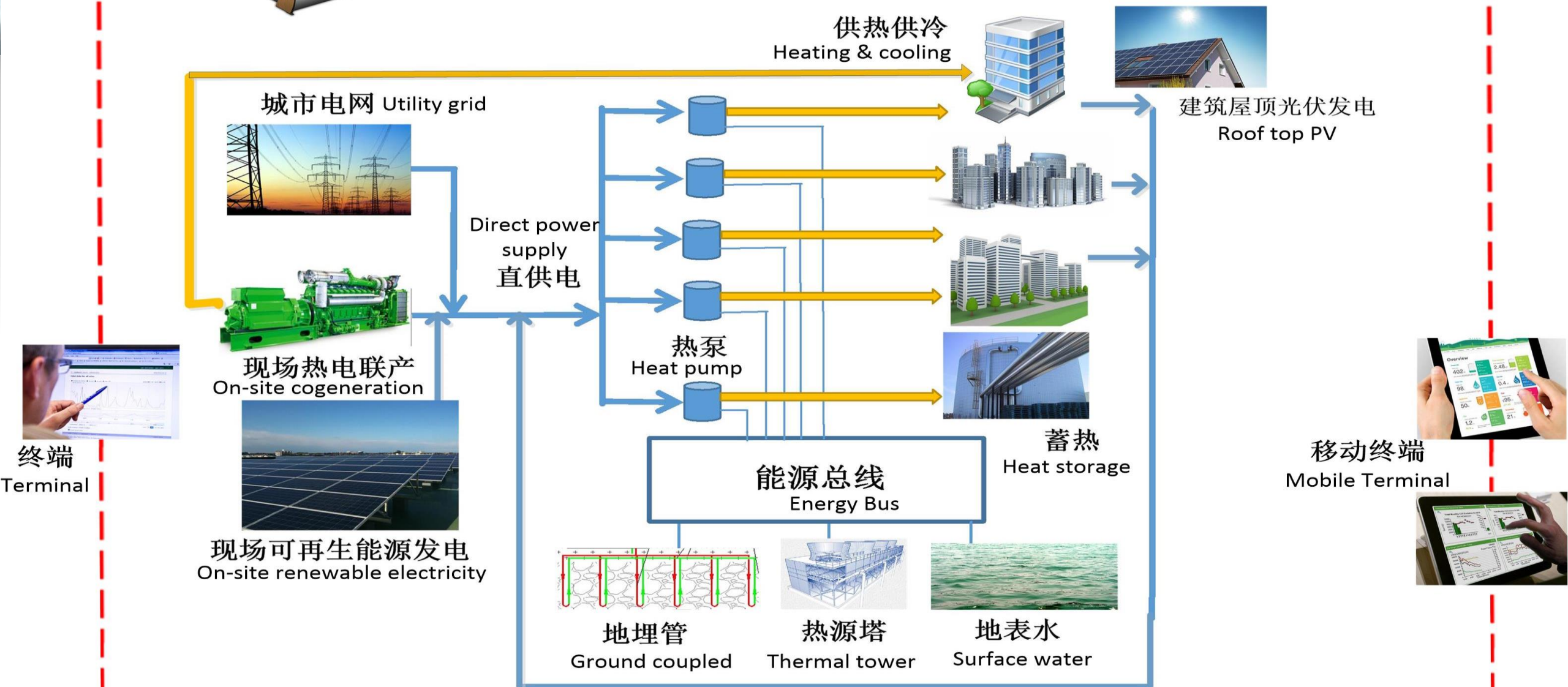
未利用能源
Untapped Energy

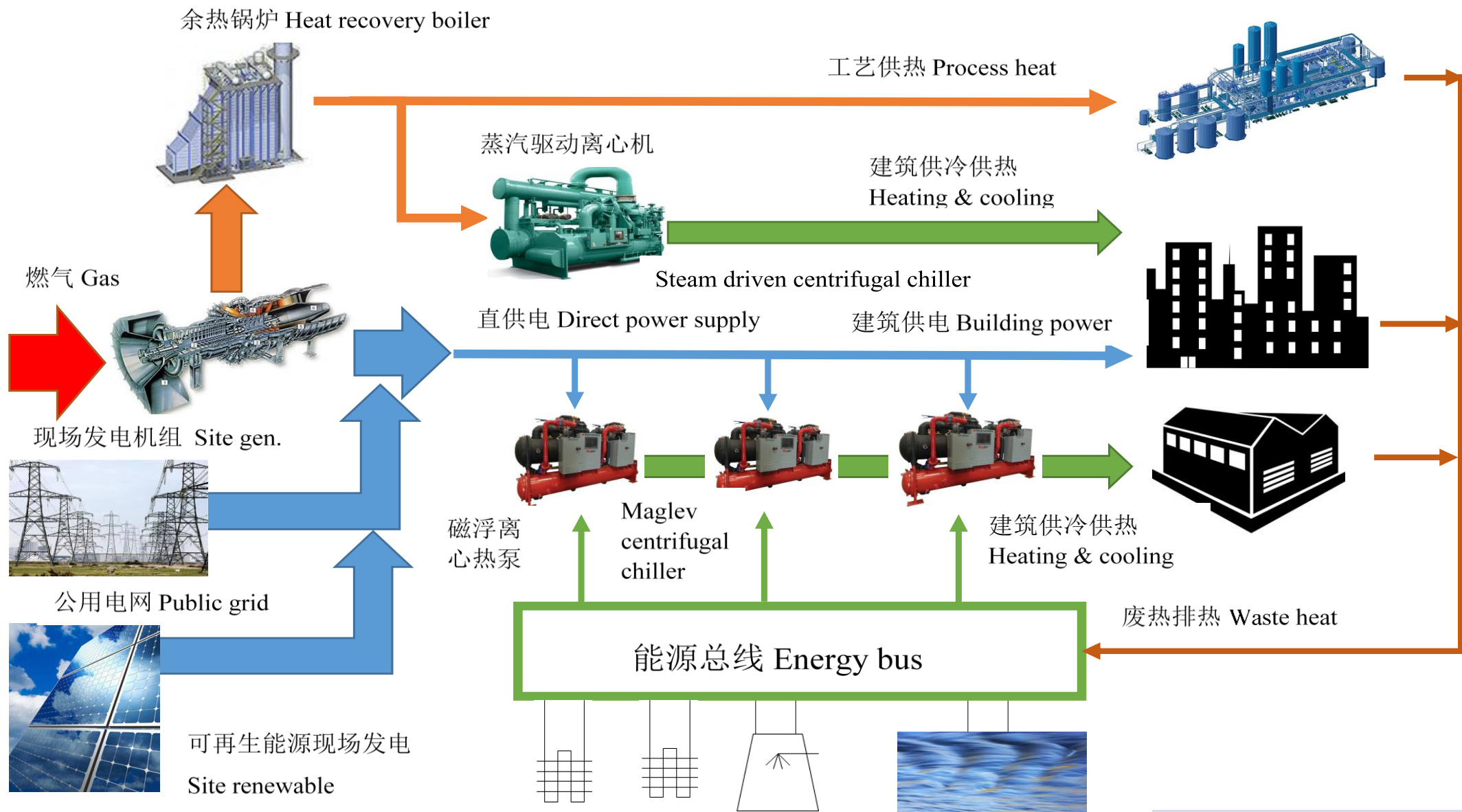
城区能源微网的三个层次 The three levels of
urban micro energy net



能源管理系统 Energy management system

能源微网 Community micro energy network





MEN in the industry park

能源总线利用多个热源/热汇 The energy bus: using multi heat source/sink

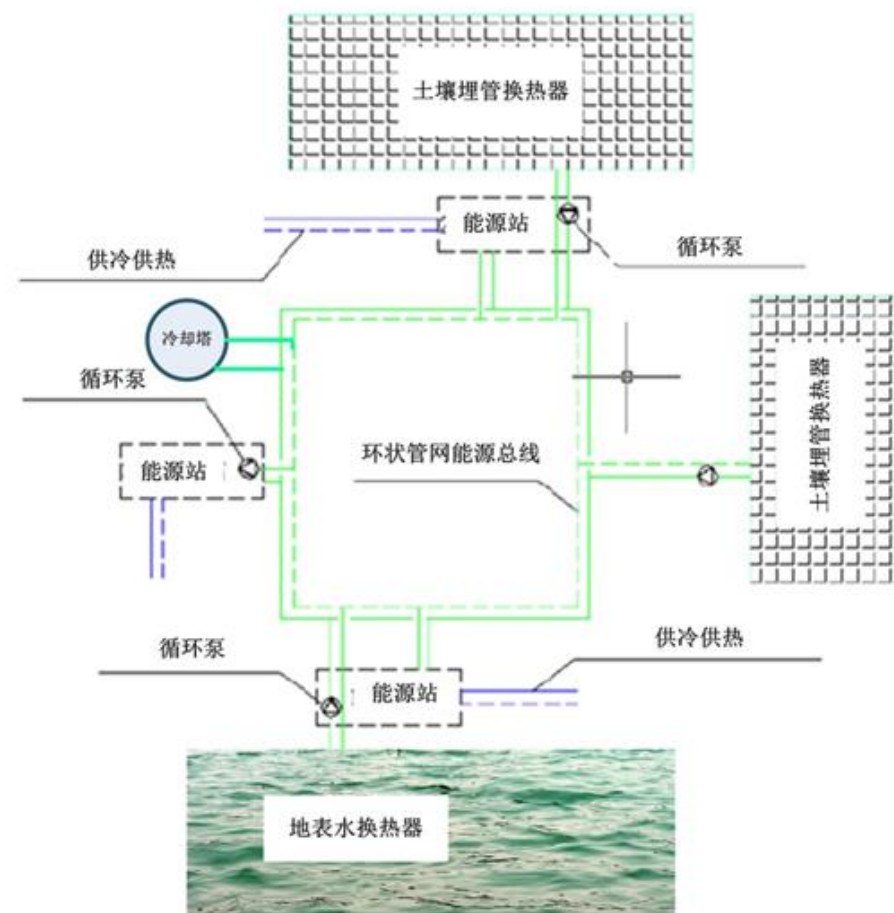
概念来自于计算机科学。The concept of energy bus is from computer science.

分布式热泵的热源/热汇。Heat source/sink for distributed heat pump

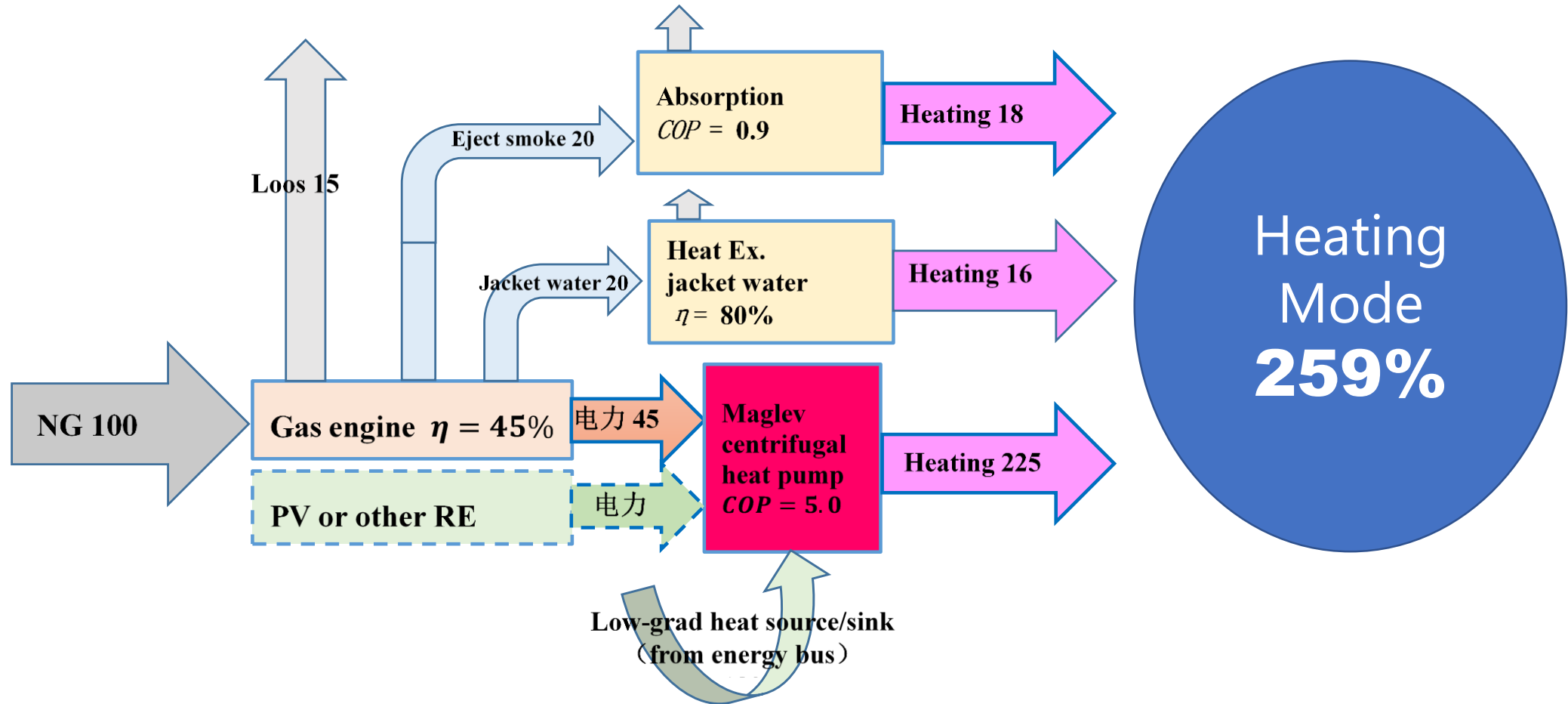
可以利用多个热源/热汇，天然的或人工的。A circle pipe line to integrate various natural or artificial heat sources/sinks

利用土壤源热泵冬季供暖的性能优势，避免地表水源热泵冬季供暖的劣势。Complement the performance of different type heat pumps

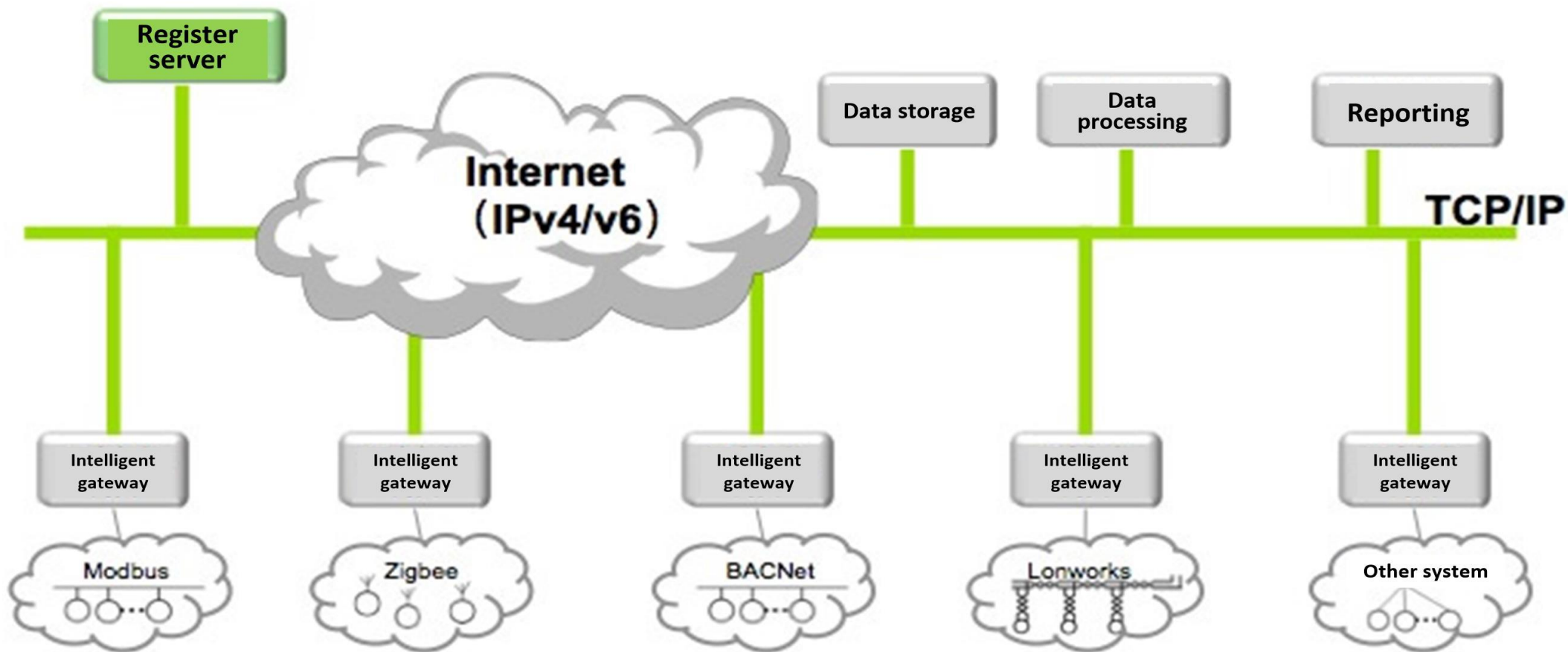
整合资源的空间分布 Integrate the spatial distribution of the resources



非常高的一次能源效率 Very high primary energy efficiency

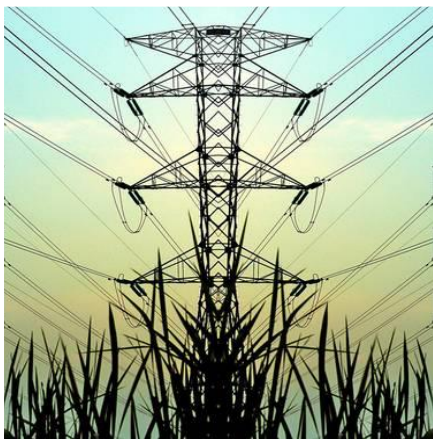


泛在网络协议 Management system: Standard of IEEE 1888 (Ubiquitous network)



第三代分布式能源系统需要通过需求侧能源规划实现

The third generation distributed energy system needs to be realized through the demand side energy planning



供应侧规划：可靠性原则，峰值负荷+冗余

Supply Side: Reliability principle

Peak load + Redundancy

需求侧规划：综合资源规划原则，终端节能作为

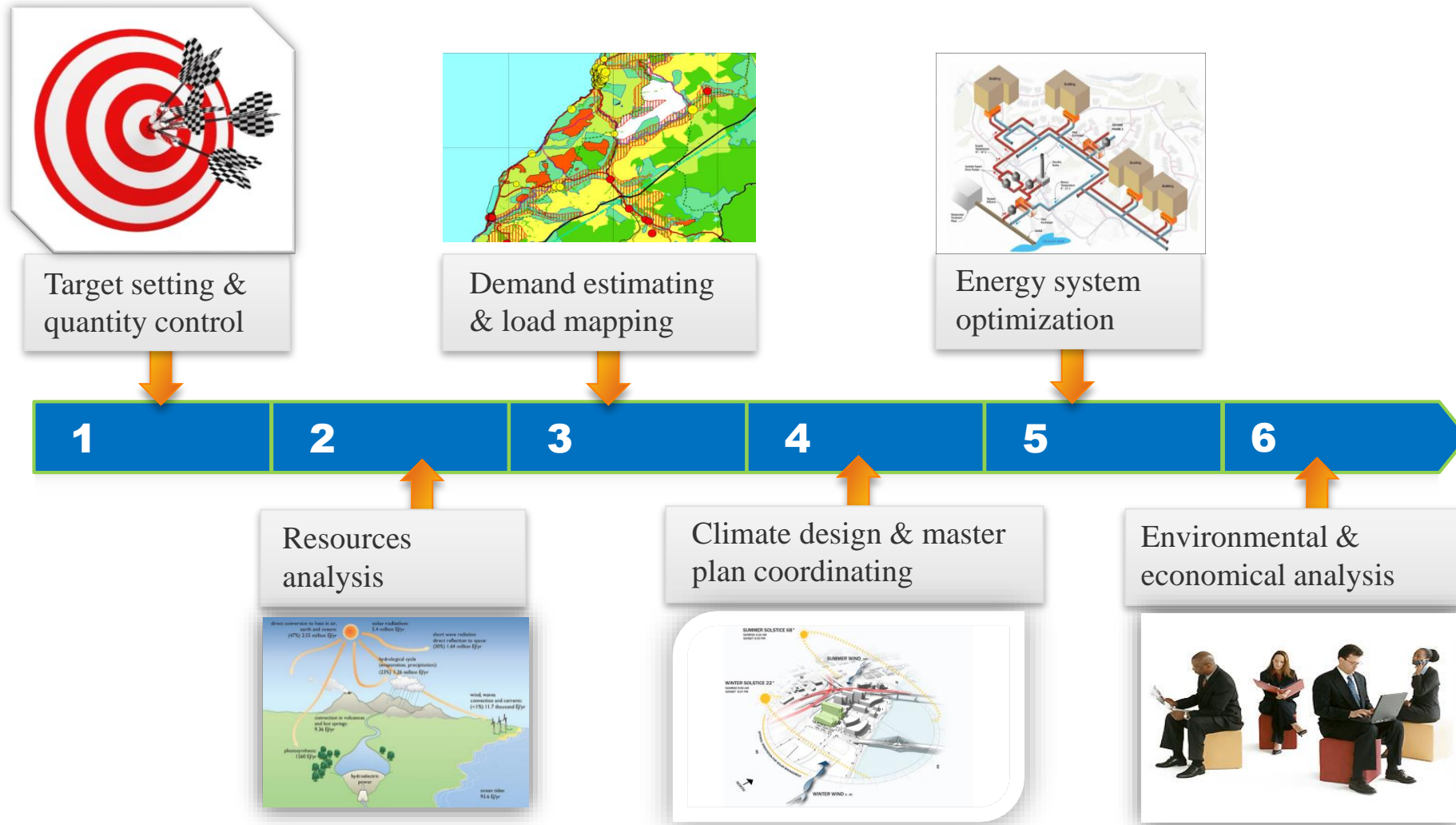
一种资源 **Demand Side:** Integrated Resource

Planning (IRP) principle

Energy saving of end use as an alternative resource



需求侧能源规划的6个关键步骤Six key steps of demand side energy planning



总结 Summary

基于第三代分布式能源的区域能源系统 District energy system based on third generation of distributed energy should:

- 需要需求侧能源规划 Need demand side energy planning
- 是集成各种可利用资源的多源系统 Is a multi-source system that integrates various available resources
- 现场发电系统是它的核心 On-site electric generation system is its core
- 分布式热泵系统和能源总线是它的框架 Distributed heat pump system and energy bus are its frame
- 需要智能化的能源管理系统 Need smart energy management system



Thank You for Listening!

