让我们共同打造气候中和的未来
Building a climate-neutral future together

中华人民共和国
住房和城乡建设部

IBE环能科技
中国建筑节能协会

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

intep
skat Swiss Resource Centre and Consultancies for Development

中瑞零碳建筑研讨会——高效能源回收

ZEB Talk – HIGH-PERFORMANCE ENERGY RECOVERY

2024年10月24日

October 24th 2024

Joachim Lennarz

Managing director of the Konvekta group

Konvekta 集团 (Konvekta Group)

架构&产品 (Structure & Products)

ZEB
让我们共同打造气候中和的未来
Building a climate-neutral future together

konvekta

我们是Konvekta， 经验&创新

We are Konvekta Experience & Innovation

- 闭式循环的热回收系统制造商
  Manufacturer of efficient closed loop systems

- 全球化的瑞士家族企业，源自瑞士的生产、设计、研发
  International company under private ownership with production, engineering and development in Switzerland

- 全球技术领先，感谢自1949年开始的不间断研发
  Technology leader – continuous Innovation since 1949

- 自1975年起，基于IT的研发，建立起优化算法的数学建模，以实现运行、控制的实际工况
  IT research, use of mathematical modelling algorithms for design optimization and system control since 1975

实实在在地节能

Technology that delivers

建筑贡献了 全球**35%**的CO2排放

Impact of building sector: **35%** of worlwide CO2 emissions

高达**95%**的年度热回收效率

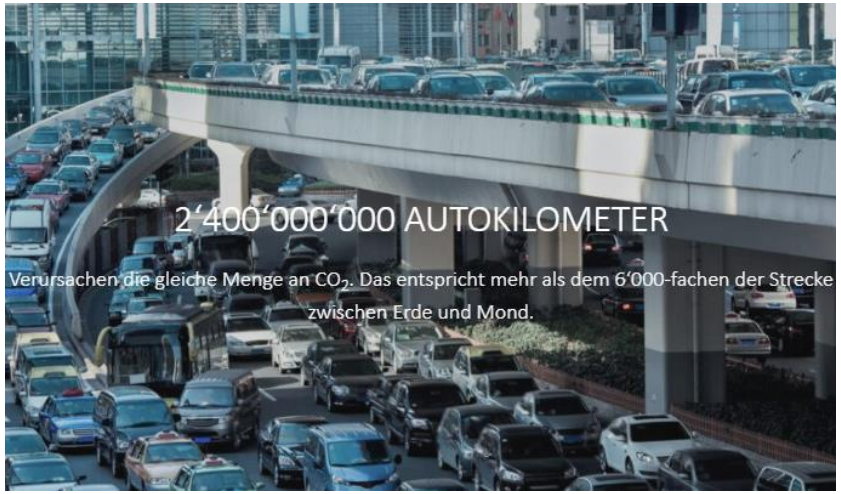
Annual utilization rate: up to **95%** reusable heat

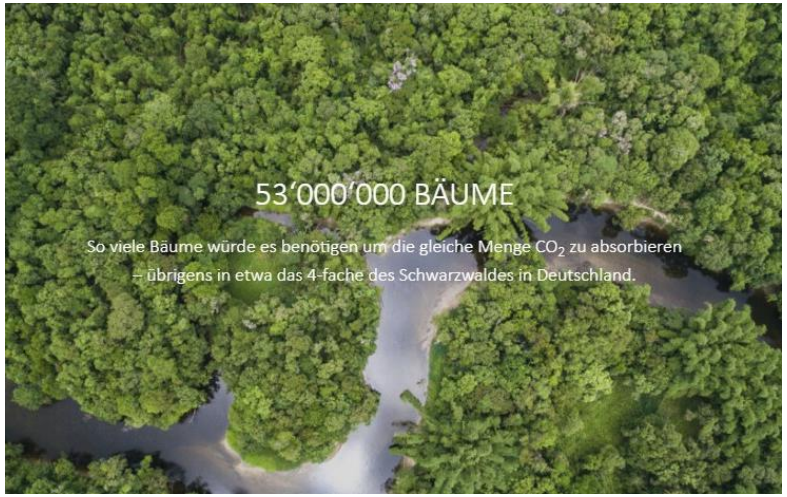
全球已有超**100,000**件Konvekta盘管在运行

Konvekta has produced more than **100.000 coil units**.

全球已有超**530,000**吨CO2/年减排由konvetka贡献

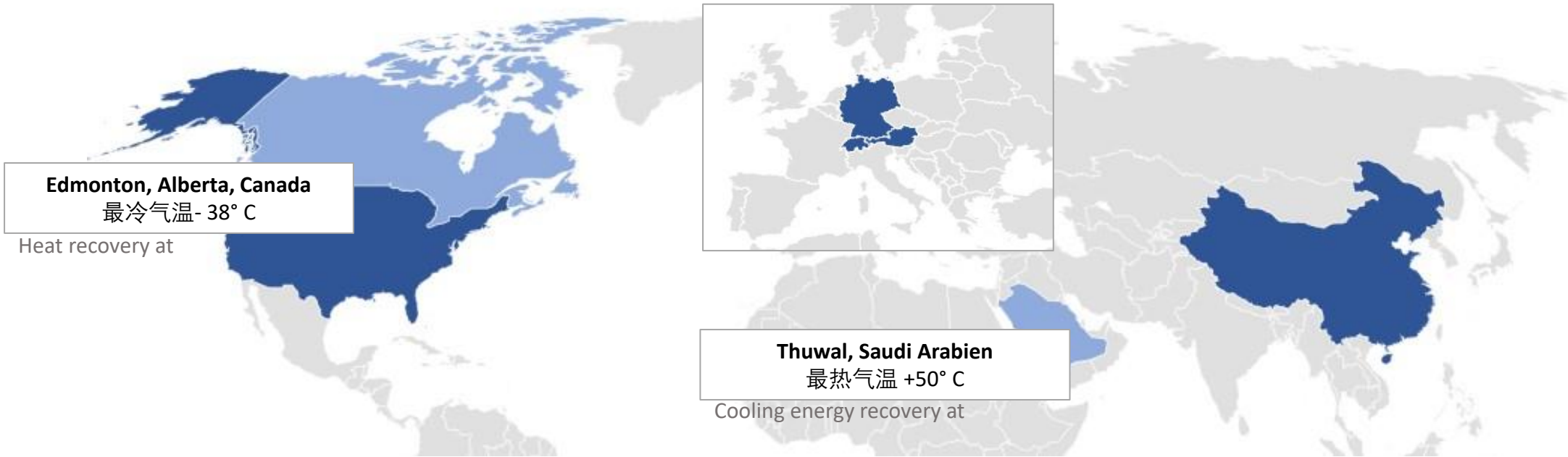
Savings of all Konvekta systems worldwide: currently **530’000t CO2 / year**





基于瑞士的全球企业

Located in Switzerland yet at home worldwide



Konvekta 集团 全球子公司

Subsidiaries of the Konvekta Group

1992 德国 Germany

2010 美国 USA

2018 中国 China

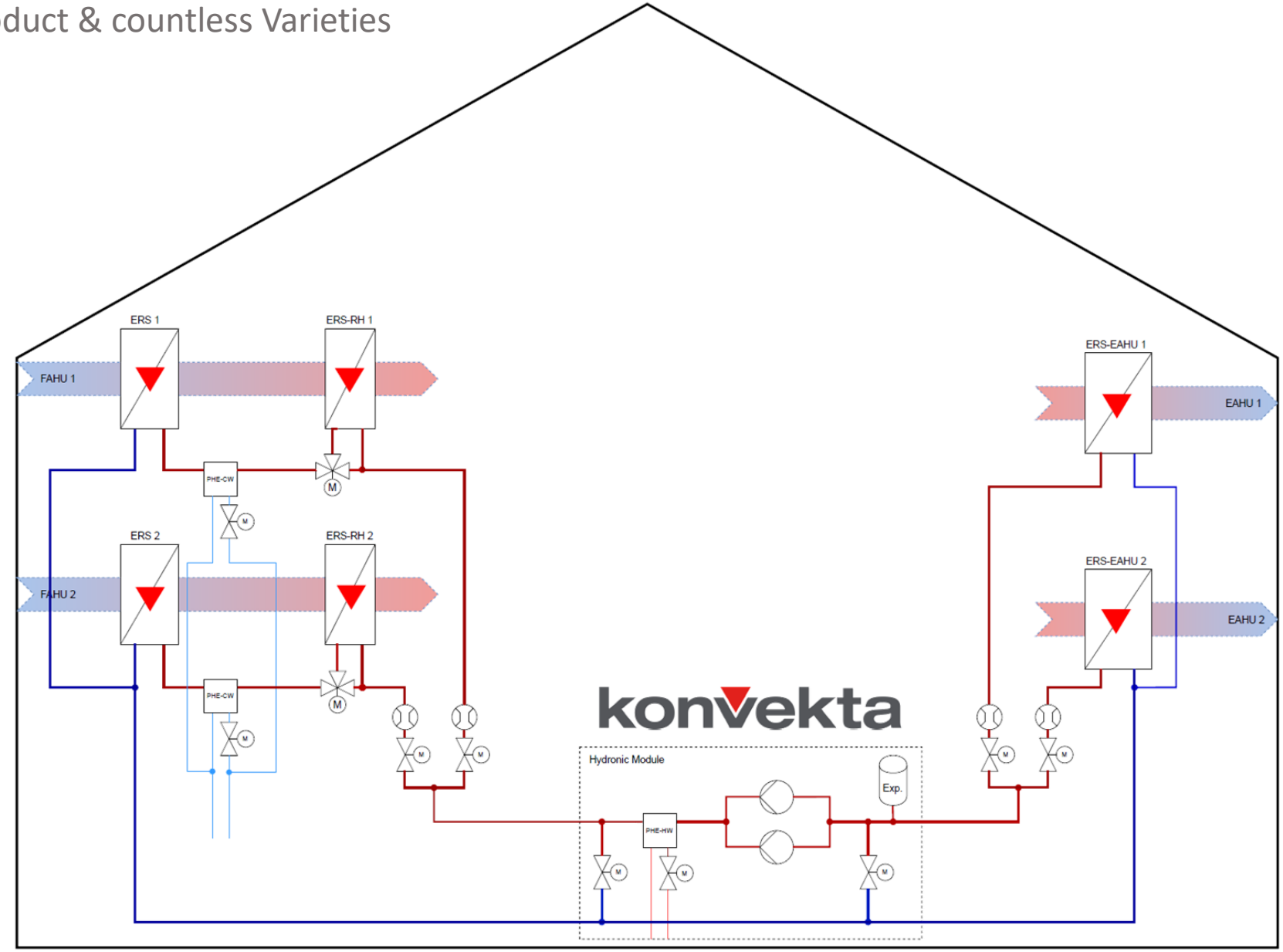
2019 奥地利 Austria

主动式热回收 一套系统，多种解决方案

Closed Loop System: one Product & countless Varieties

KONVEKTA SYSTEM ANIMATIONS

https://www.youtube.com/channel/UC8lNENWSXgRkRiTIA_LFIBA



ZEB

让我们共同打造气候中和的未来

Building a climate-neutral future together

一套Konvekta系统 多种高效、灵活的解决方案

Konvekta Systems: High-performance Technology from a single Source

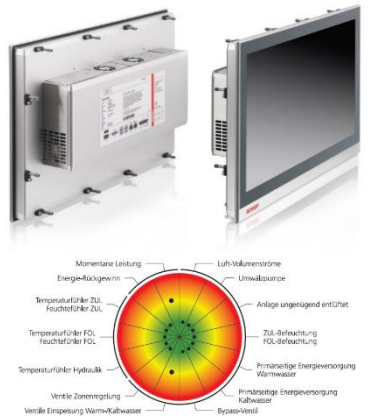
Konvekta的每套系统都是独一无二的，针对客户不同的运行习惯、气候数据订制设计盘管、控制器。项目初期阶段，Konvekta即提供客户预计的能效表现，运行阶段通过实时优化的方式确保该指标实现，提供客户**高效、稳定**的热回收效果。

Konvekta systems consist of precisely matched components, all of which originate from Konvekta and are all specifically developed, produced and **optimized as an overall system** for the application. Due to the analytical approach Konvekta guarantees the **reliability of the planning data and the energy recovery** already during an early pre-implementation phase.

高效热回收盘管
Heat Exchanger

水力模块
Hydraulic Skid

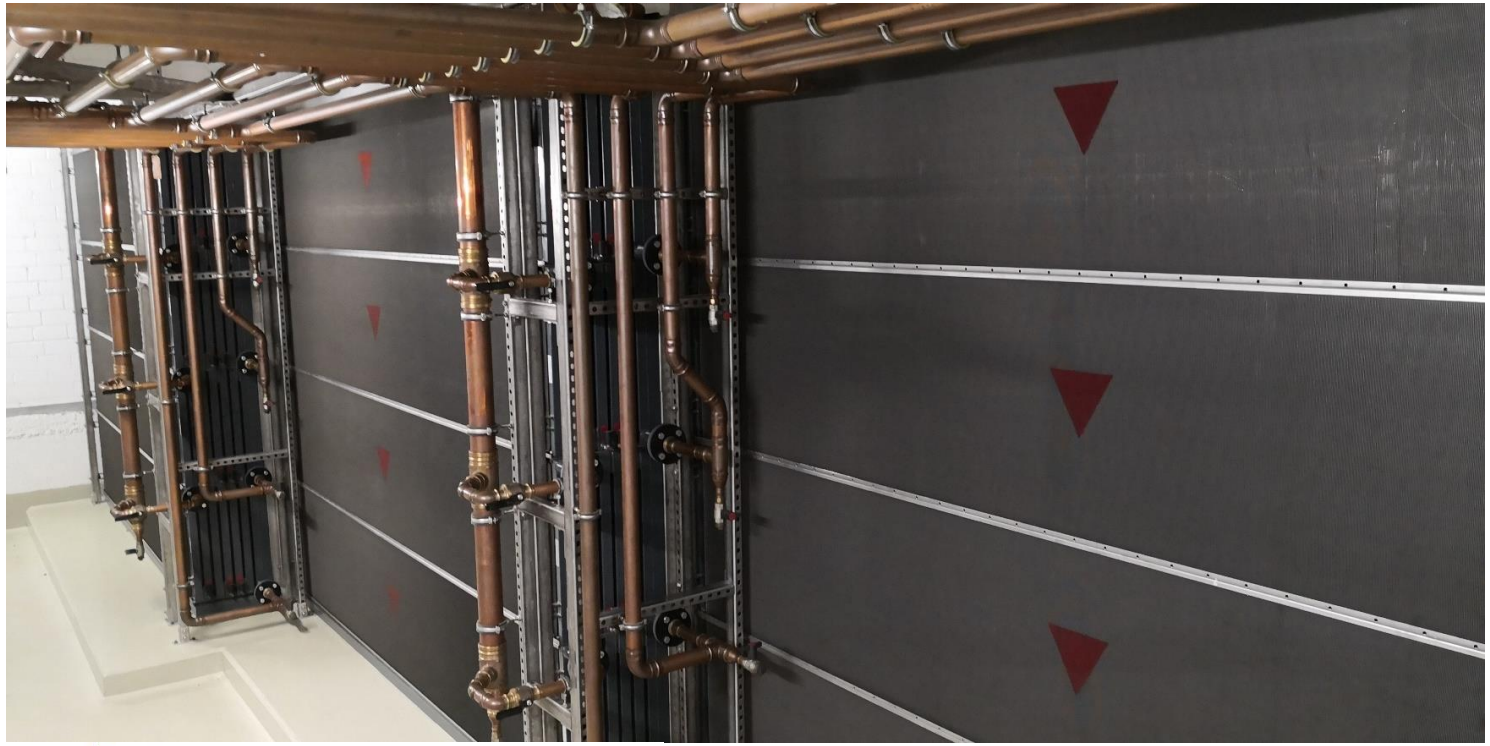
控制器
Konvekta Controller

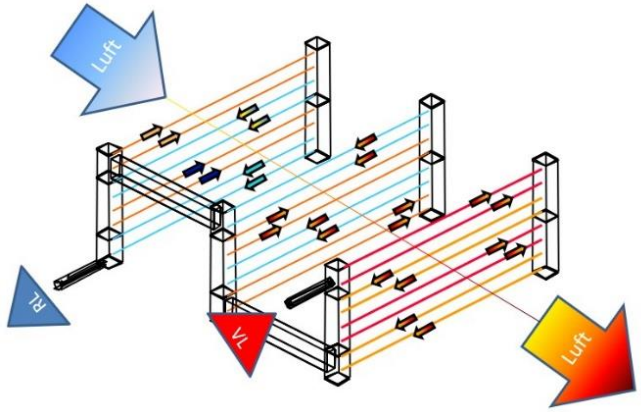


一种高效盘管 多种设计参数

One Heat Exchanger: Countless Designs

- 订制设计
  Application-specific design
- 双侧集管
  Dual-side collectors
- 灵活水路
  Flexible water circuit
- 几乎完美逆流换热
  Almost perfect counterflow



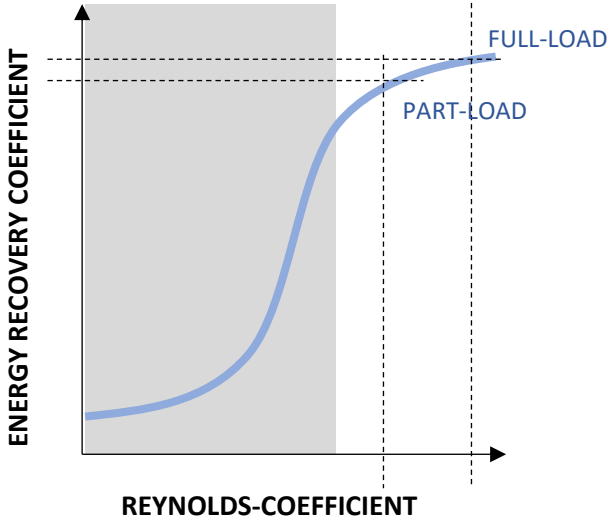


Konvekta 高效热回收盘管 技术核心

Heat Exchanger: Technological Advantages

有别于传统空调盘管，Konvekta热回收盘管更加高效、紧凑，在变工况下仍实现稳定换热效率。

Compared to conventional units Konvekta heat exchangers achieve very high energy recovery coefficients in the smallest space due to their efficiency and the specific layout covering the clima cycle of the entire year.



变工况下的紊流运行

Turbulent flow in full-load and part-load operation

高效、紧凑

Space saving compact design

Konvekta 水力模块

The hydraulic Skid

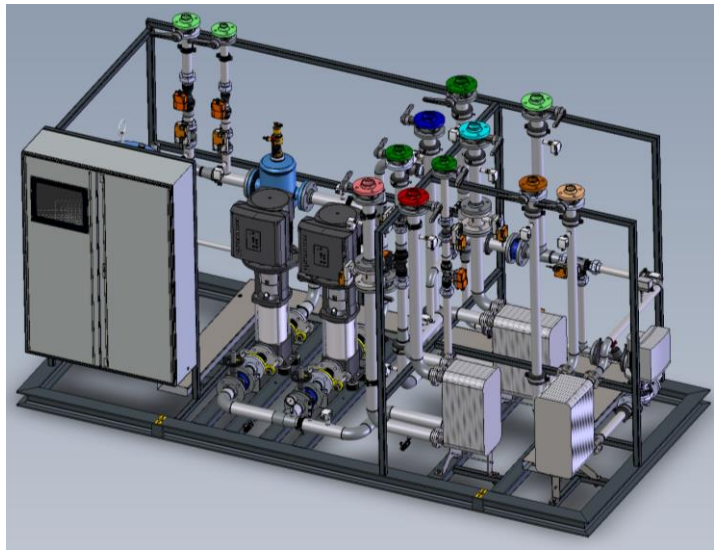
- 特殊订制设计
  Application-specific layout

- 集成化制造，品质稳定、运维方便
  Centralized, easily accesible and maintainable – controller, pumps, bypass valves and sensors

- 应用于自简单至复杂的各种工况
  One skid of single but also for compound systems

- 灵活的水力设计，可实现多项功能
  Integration of applications such as free cooling

- 与BIM数据的集成规划
  Integrated planning with BIM data

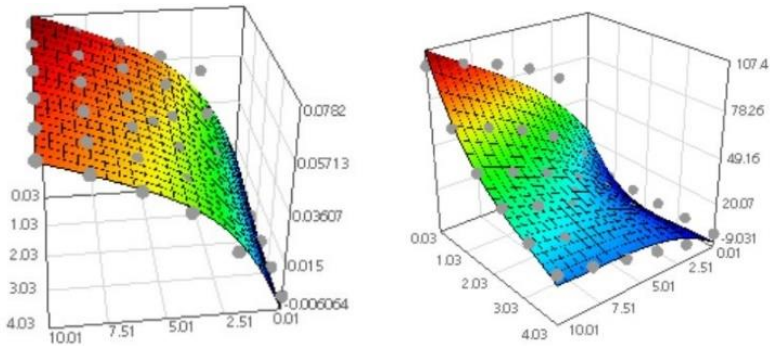


Konvekta 控制器 基于全球顶尖IT技术

Konvekta Controller: Exploiting Potential through sophisticated IT

- **基于需求的控制** – 仅在循环泵消耗的电力可以产生大量的回收效益时，热回收才会开启
- **智能群控系统** – 基于各个硬件的特性以及顶尖的群控算法，实现热回收能量在多个单体间最优化分配

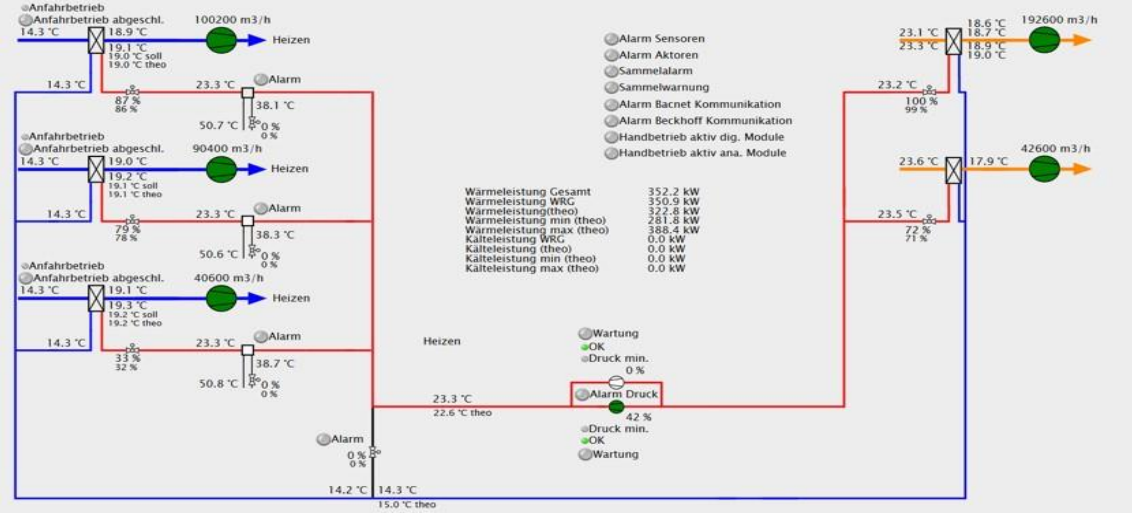
- **Demand-based control** – valve positions, reduction of pump speed according to operating parameters with focus on minimization of electrical consumption
- Net energy recovery based on the **characteristic curve fields of the components**. The exact control behaviour of all components are available in the controller library and are the basis for the efficient control of the entire system.

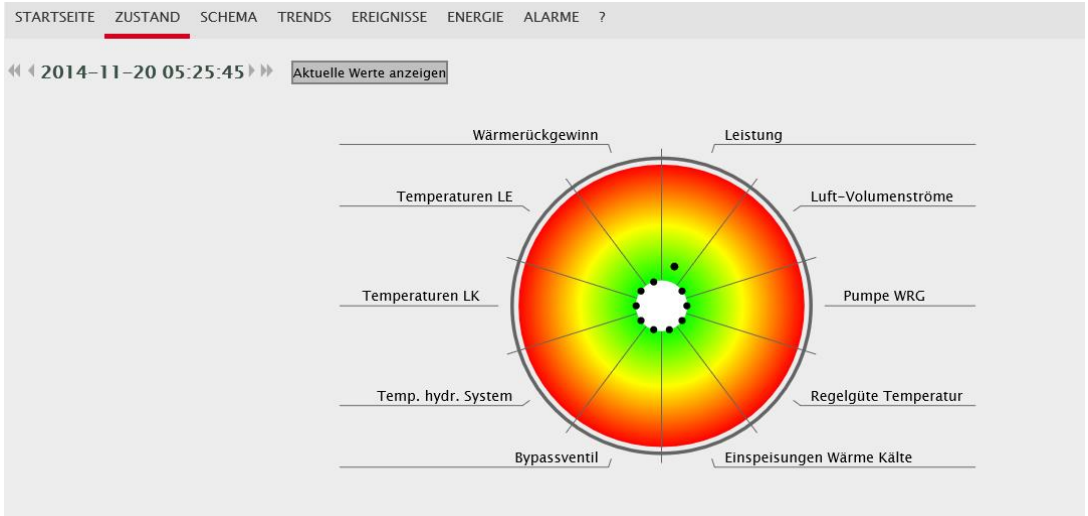


Konvekta 控制器 运行状态实时汇报

Konvekta Controller: Status Details & Aggregation States

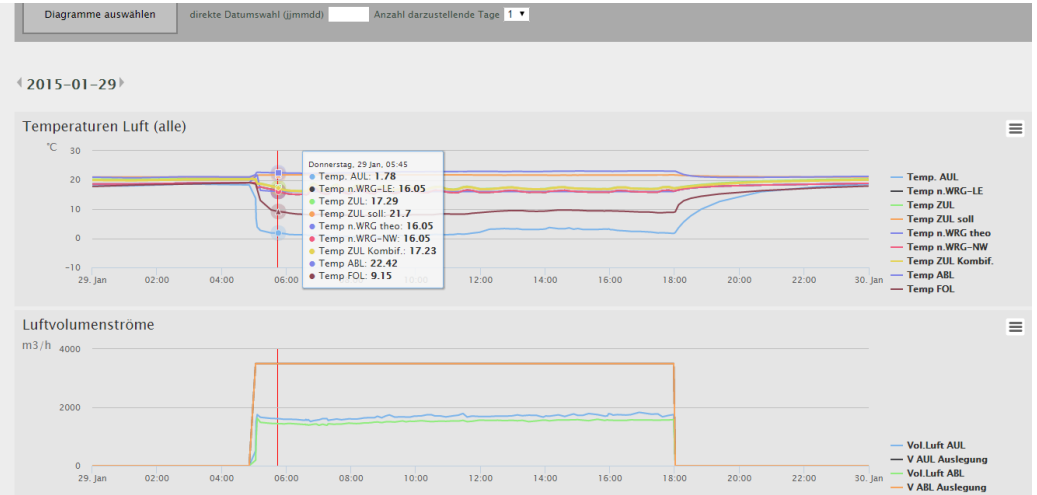
- 信息量丰富的人机界面，可以实时观察各部件的运行参数
  Detailed data (current, historical, graphs) are available in the controller for monitoring and analysis
- 实时运算最优点算法，故障排除
  Aggregate states support system optimization and troubleshooting
- 基于实测数据的能耗验证
  Performance data allow the verification of system efficiency and achievement of recovery data
- 本地、远程控制
  Access can be local or remote

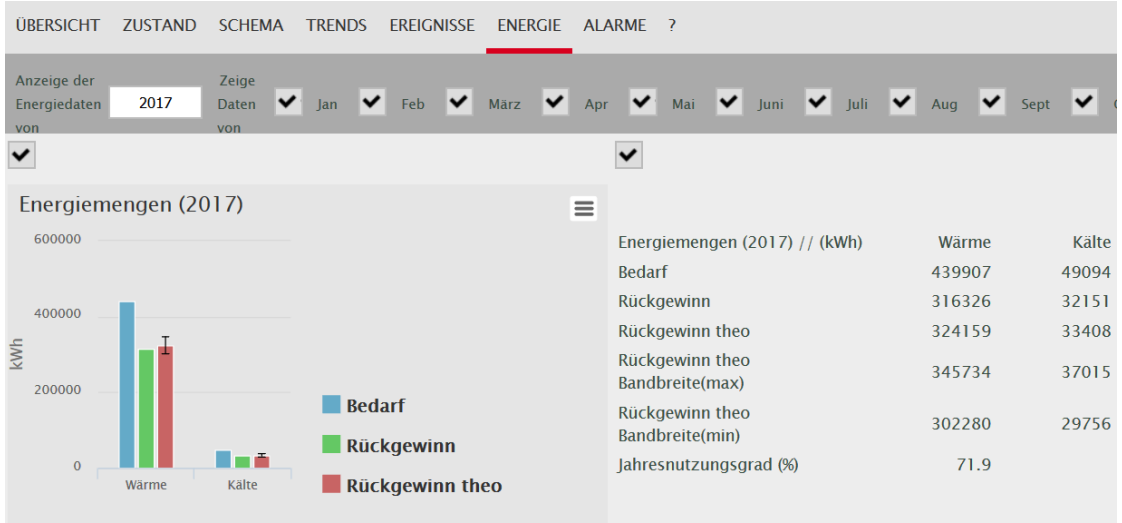




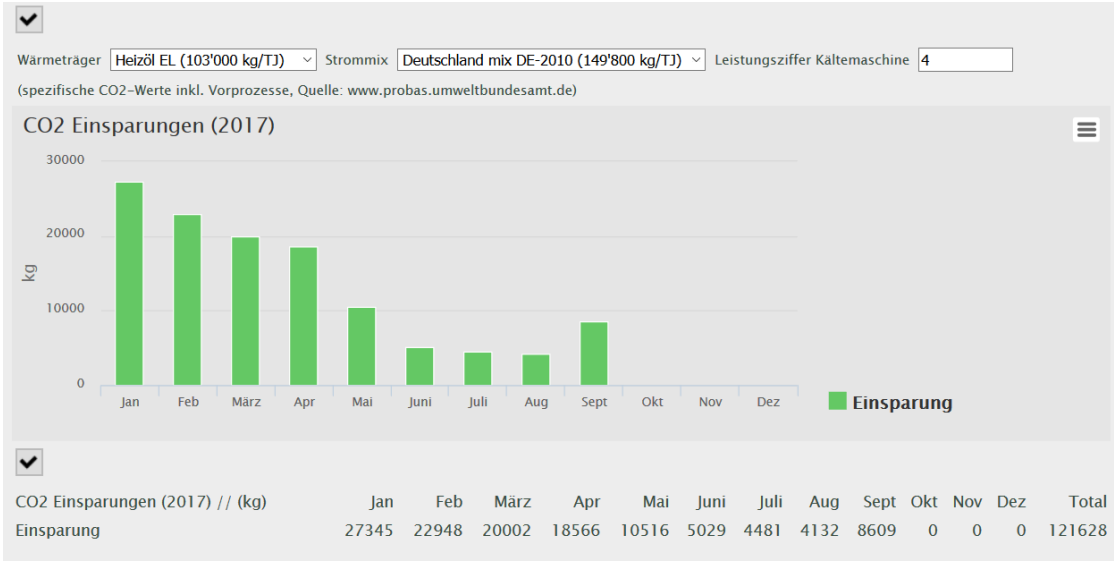
Konvekta 控制器 明明白白的数据调阅、跟踪

Konvekta Controller: Transparency & Traceability





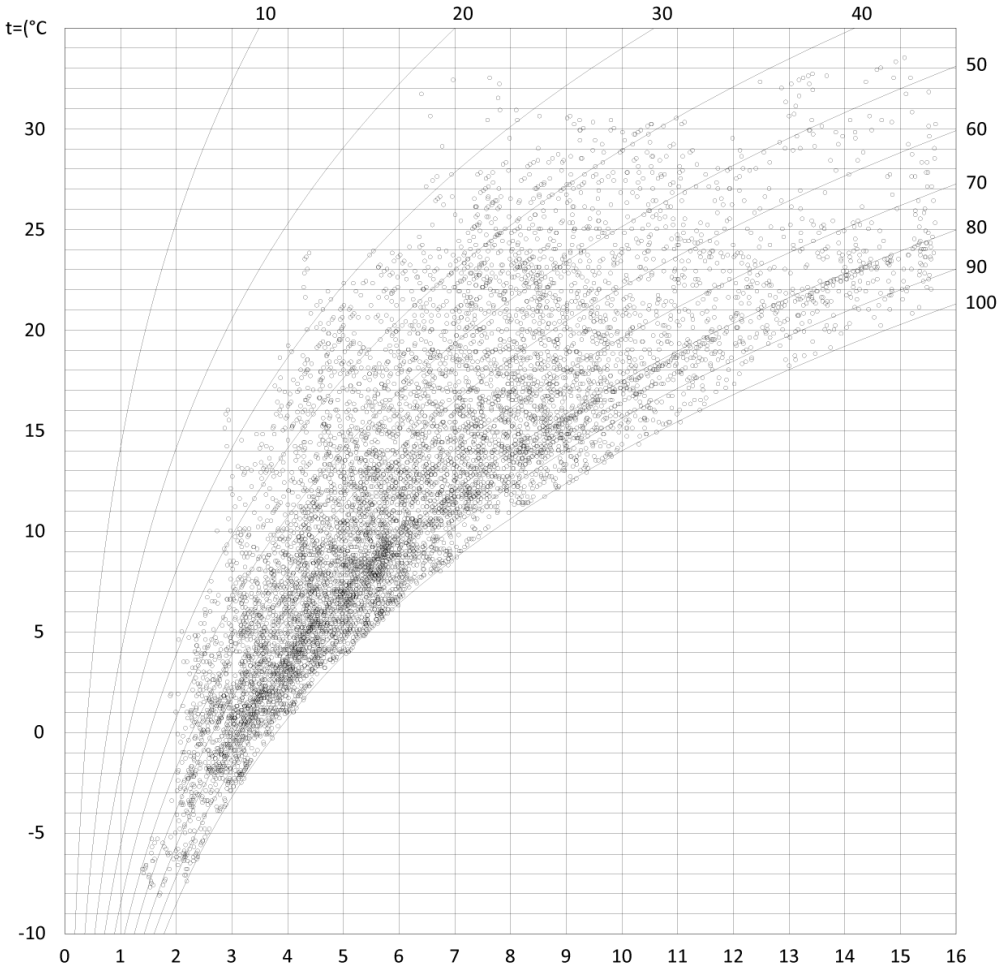
Energiemengen (2017) // (kWh)	Wärme	Kälte
Bedarf	439907	49094
Rückgewinn	316326	32151
Rückgewinn theo	324159	33408
Rückgewinn theo Bandbreite(max)	345734	37015
Rückgewinn theo Bandbreite(min)	302280	29756
Jahresnutzungsgrad (%)	71.9	



CO2 Einsparungen (2017) // (kg)	Jan	Feb	März	Apr	Mai	Juni	Juli	Aug	Sept	Okt	Nov	Dez	Total
Einsparung	27345	22948	20002	18566	10516	5029	4481	4132	8609	0	0	0	121628

Syskon4.0 基于顶尖IT技术的算法平台

Syskon4.0 IT-based Design & Investment Decision



逐时设计 Performance Analysis

- 如何设计最合适的热回收及能源站，满足各种工况下的负荷需求?

  How must the system be designed andd configured to provide the necessary performance in all situations?

  - 负荷/布局 Size/Layout
  - 成本 Cost

能耗分析 Energy Analysis

- 如何确保在任何工况下都实现最大化的能源回收?

  How can I ensure that maximum energy is recovered at all times?

- 每年实现多少能耗节约/ CO2减排?

  How much Energy / CO_2 does the system save me each year?

  - 所在地气候逐时计算 Yield calculation
  - 生态、经济投资分析 Ecological and economic investment consideration

→ **最合适的解决方案** Both aspects are indispensable

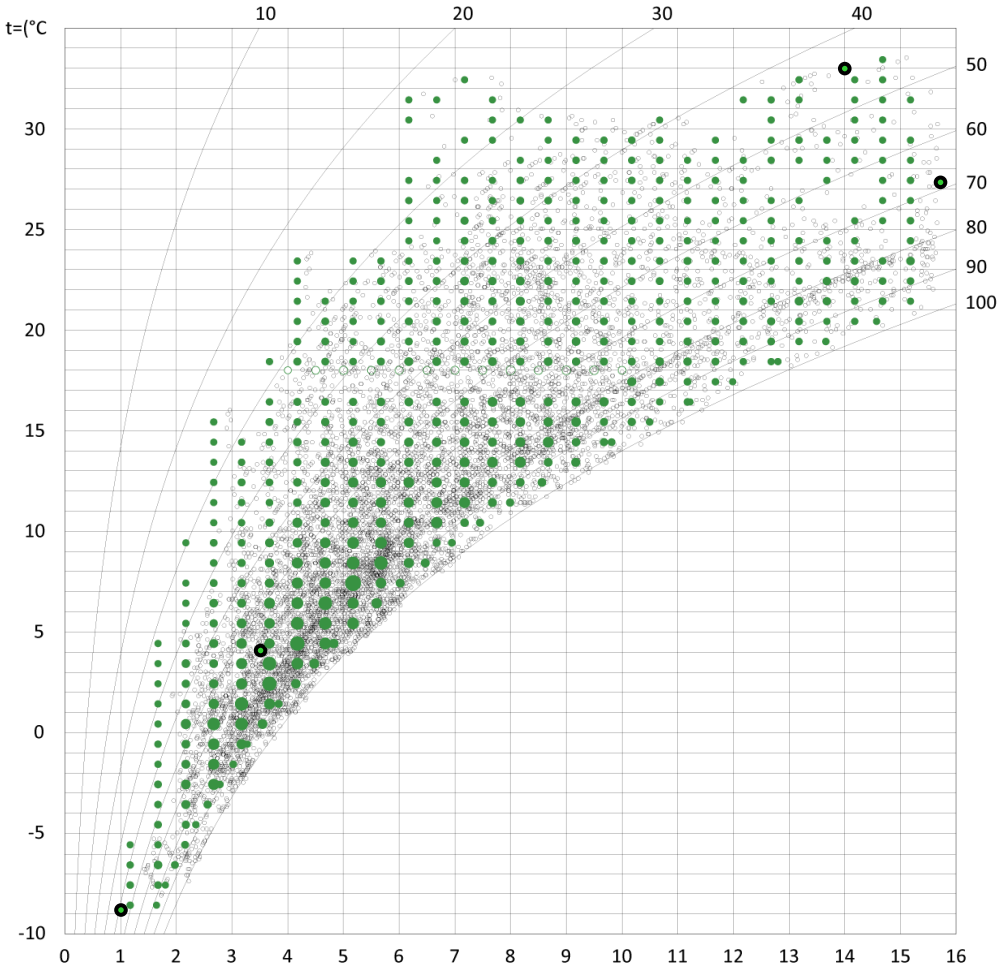
ZEB

让我们共同打造气候中和的未来

Building a climate-neutral future together

Syskon设计

Syskon Design



尖峰、平时负荷分析:

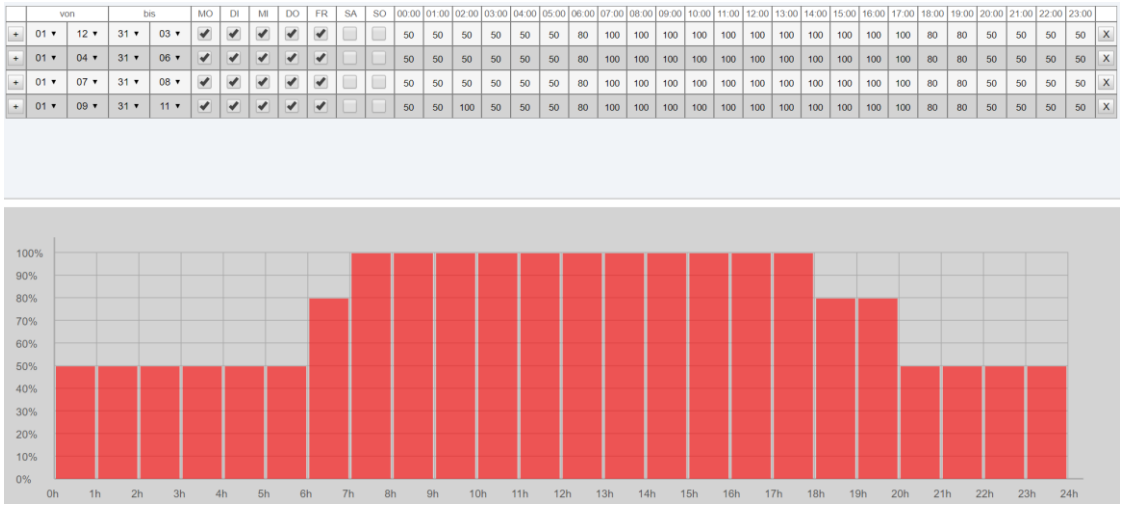
In addition to analyzing peak power and nominal conditions:

- 基于项目所在地气候数据计算，8760h/年 逐时分析

  Calculation of all system states and energy savings based on 8‘760h per year with climate data of the specific site.

- 客户运行习惯也是影响设计的因素

  Optimization taking into account user behaviour



ZEB

让我们共同打造气候中和的未来

Building a climate-neutral future together

迭代优化

Iterative Optimization

- 所有边界条件下的分析数据

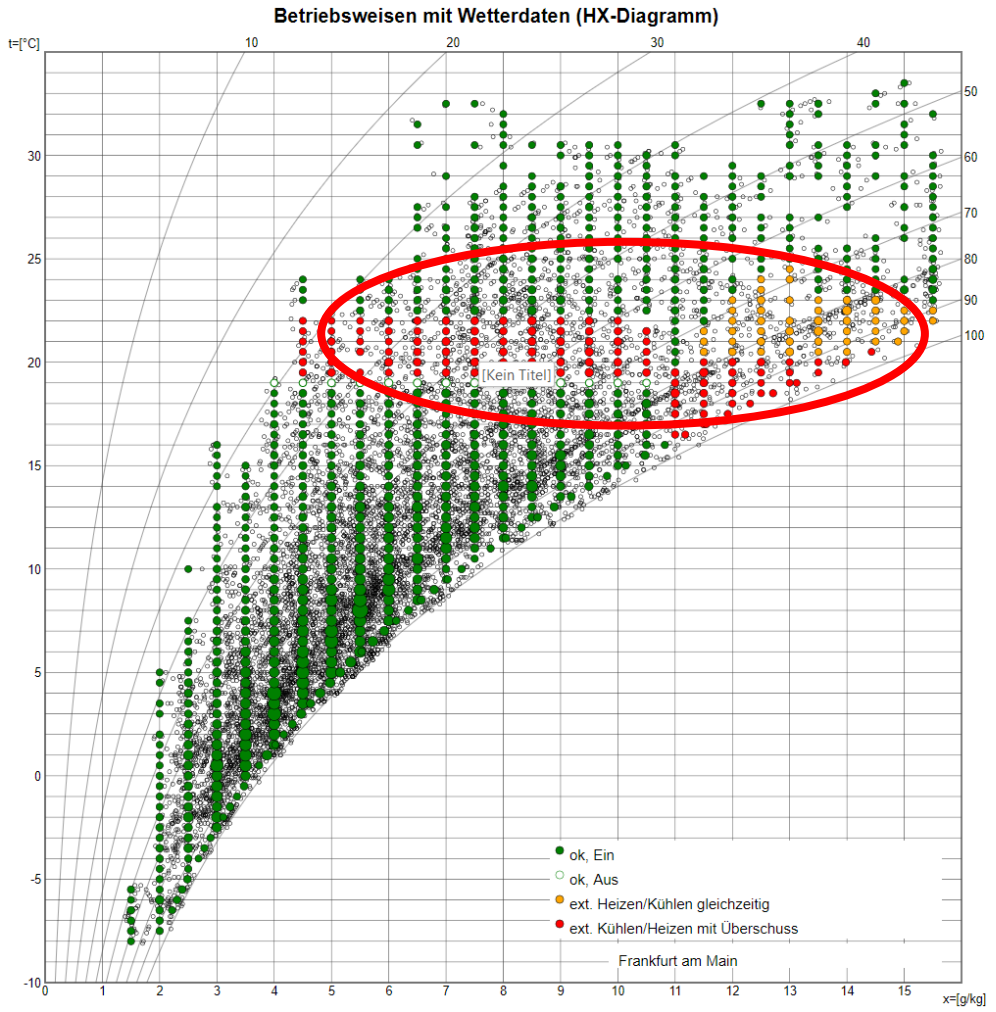
  Knowledge of all states under all boundary conditions

- 非最优表现区域甄别

  Identification of problem areas

- 迭代优化 (经济效益比权衡)

  Iterative optimization (taking into account the cost trade-off)

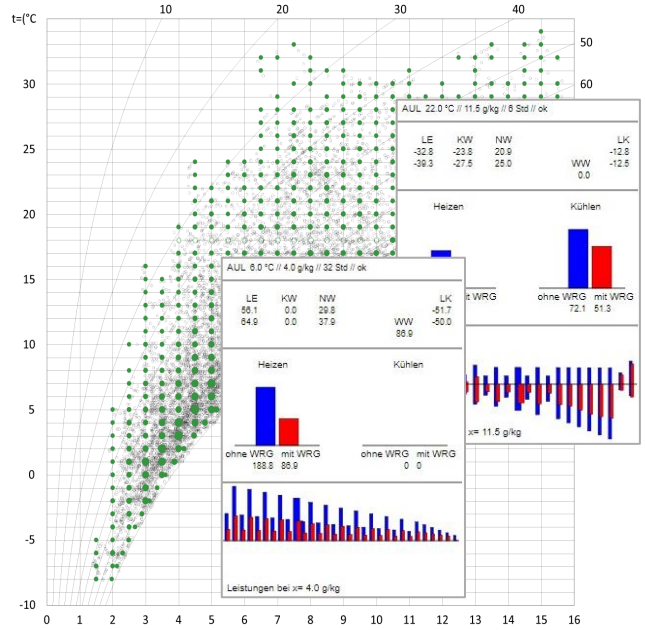


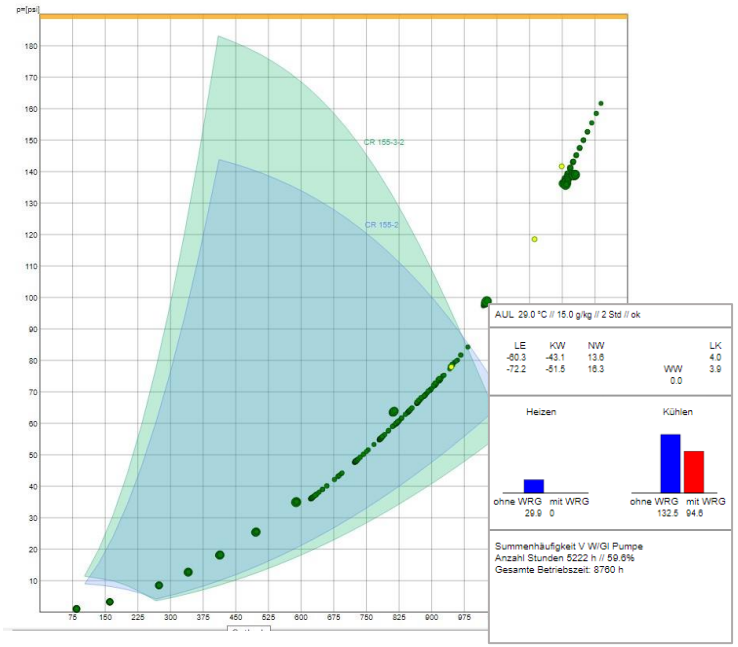
迭代优化

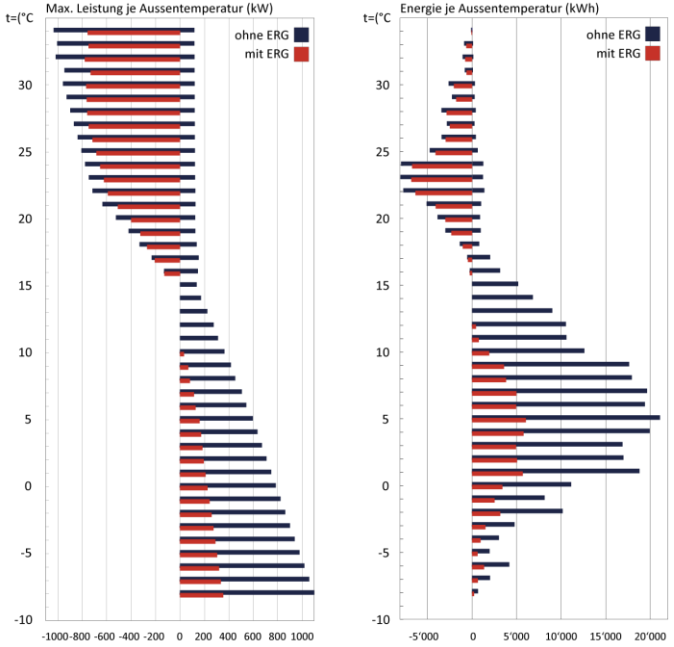
Iterative Optimization

不限于软件层面的数据优化，每个组件的订制设计，对最大限度降低客户能耗也至关重要

Not only the energy and performance data are optimized but of course also the appropriate use of the right components in order to minimize energy consumption of the system.







重点：净能量收益

Crucial: net energy gains

零碳排放(ZEERS)

Zero Emission Energy Recovery System

基于热泵技术
- 高效
- 无化石能消耗

Use of heat pumps / chillers
- Efficient
- No need for fossile fuels

有别于依赖地源或气候的零排放方案，热回收系统更具优势:

Compared to geothermal probes or outside air based approaches the use in energy recovery systems is particularily useful:

- 极少的对外能源（如：供电）需求
  Small residual energy demand
- 低投资
  Low investment costs
- 利用废气中的额外能量
  Use of additional energy in the exhaust air

零碳排放(ZEERS)

Zero Emission Energy Recovery System

地域 Field input： 无条件供应化石能

Customer requirement: use of fossile fuels prohibited in some cities

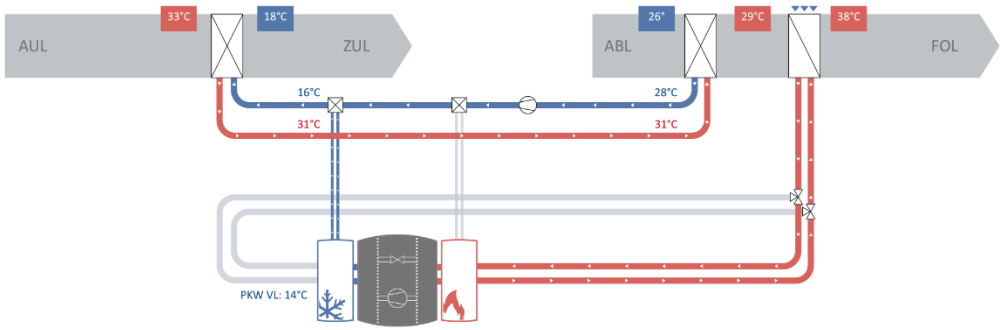
实施 Approach： 排风热回收与热泵技术可逆结合

Integration of heat pump/chiller in ERS in reversible operation

案例 Implementation： 美国、德国、瑞士

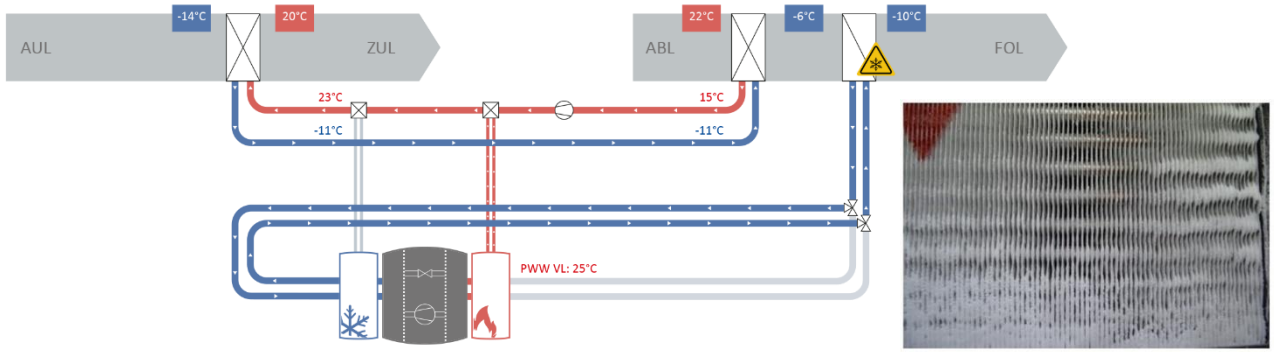
Currently: USA, Germany, Switzerland

Sommer



等焓降温 Energy sink – adiabatic cooling

Winter



防冻保护 Energy source – provision from exhaust air down to freezing point

ZEB

让我们共同打造气候中和的未来

Building a climate-neutral future together

konvekta

ZDF

Nachrichtenstudio & Sendegebäude Mainz-DE

Energiedaten von 2014

3.417.000 kWh
Energiebedarf

3.300.000 kWh
Energierückgewinn

96,6 %
Jahresnutzungsgrad

879.000 kg
CO_2-Einsparung

660.000 m^3/h
Gesamtluftmenge

Flughafen Zürich

Flughafen Zürich - CH

Energiedaten von 2015

796.471 kWh
Energiebedarf

757.665 kWh
Energierückgewinn

95,1 %
Jahresnutzungsgrad

201.837 kg
CO_2-Einsparung

128.000 m^3/h
Gesamtluftmenge

Crona Kliniken

Universitätskilinikum Tübingen - DE

Energiedaten von 2018

8.287.880 kWh
Wärmebedarf

8.084.512 kWh
Wärmerückgewinn

2.457.790 kWh
Kältebedarf

466.763 kWh
Kälterückgewinn

97,5 %
Jahresnutzungsgrad

3.008.895 kg
CO_2-Einsparung

800.000 m^3/h
Gesamtluftmenge

Umass ISC

University of Massachusetts Boston - USA

Energiedaten von 2017

4.161.195 kWh
Wärmebedarf

3.640.576 kWh
Wärmerückgewinn

1.613.789 kWh
Kältebedarf

419.956 kWh
Kälterückgewinn

87,5 %
Jahresnutzungsgrad

970.050 kg
CO_2-Einsparung

University of Denver RSECS

University of Denver Colorado - USA

Energiedaten von 2017

1.696.028 kWh
Wärmebedarf

1.406.388 kWh
Wärmerückgewinn

761.079 kWh
Kältebedarf

380.938 kWh
Kälterückgewinn

82,9 %
Jahresnutzungsgrad

375.518 kg
CO_2-Einsparung

267.600 m^3/h
Gesamtluftmenge

合作 References

konvekta

让我们共同打造气候中和的未来
Building a climate-neutral future together

让我们共同打造气候中和的未来
Building a climate-neutral future together

中华人民共和国
住房和城乡建设部

IBE环能科技
中国建筑节能协会

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

intep
skat Swiss Resource Centre and Consultancies for Development

感谢您的关注!

THANK YOU!

提问环节

YOUR QUESTIONS?

让我们共同打造气候中和的未来
Building a climate-neutral future together

中华人民共和国
住房和城乡建设部

IBE环能科技
中国建筑节能协会

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

intep
skat Swiss Resource Centre and Consultancies for Development

中瑞零碳建筑研讨会——高效能源回收

ZEB Talk – HIGH-PERFORMANCE ENERGY RECOVERY

2024年10月24日

October 24th 2024

张振天 (Jim Zhang)

Konvetka中国区负责人

案例 01 – Invivo体内筛选平台（动物房） Case Study 01 – Invivo Animal Facility

荣 誉 证 书

CERTIFICATE OF HONOR

英崴沃（上海）生物科技有限公司

贵单位申报的基于智能群控技术的动物房余热回收系统项目，经专家组评审，被评为2024年“上海市余热利用优秀案例”。

特发此证，予以表彰。

上海市能效中心(上海市产业绿色发展促进中心)

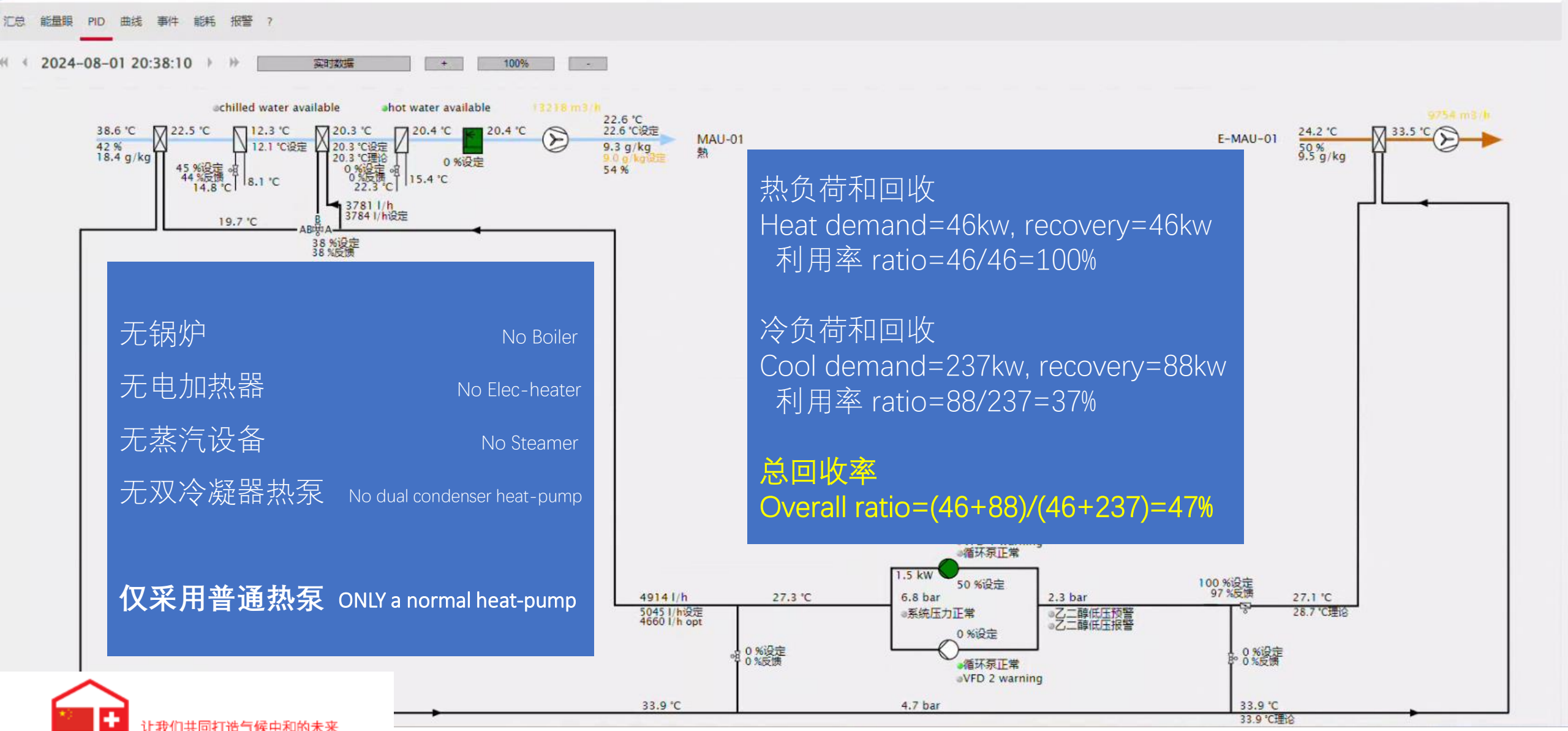
2024年5月

ZEB

让我们共同打造气候中和的未来

Building a climate-neutral future together

案例 01 – Invivo体内筛选平台（动物房） Case Study 01 – Invivo Animal Facility



无锅炉 No Boiler

无电加热器 No Elec-heater

无蒸汽设备 No Steamer

无双冷凝器热泵 No dual condenser heat-pump

仅采用普通热泵 ONLY a normal heat-pump

热负荷和回收

Heat demand=46kw, recovery=46kw

利用率 ratio=46/46=100%

冷负荷和回收

Cool demand=237kw, recovery=88kw

利用率 ratio=88/237=37%

总回收率

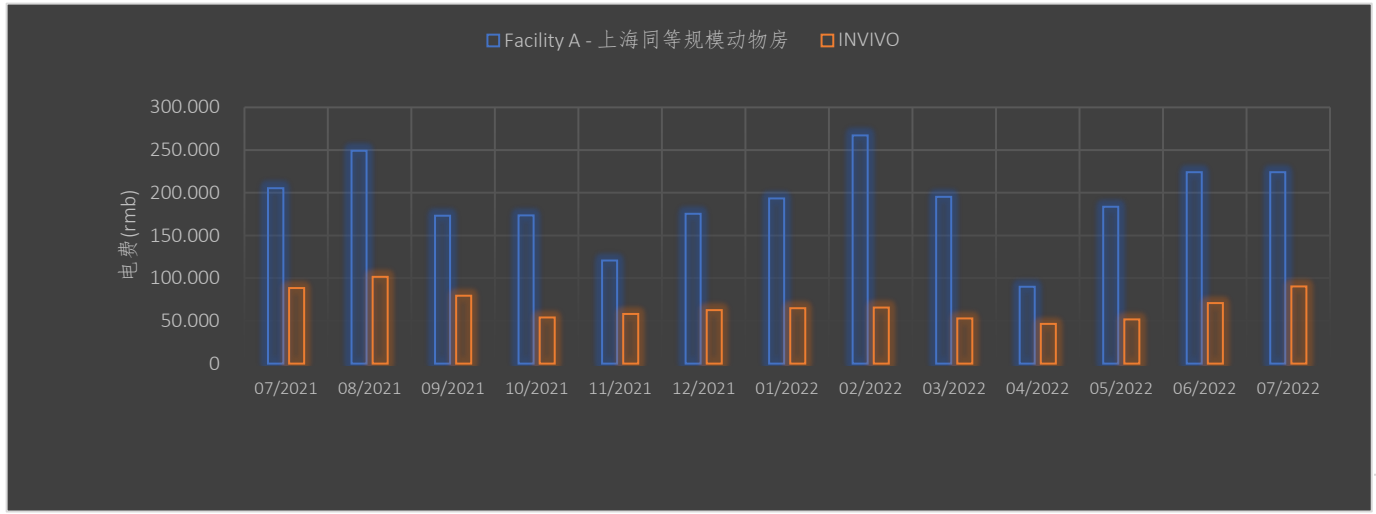
Overall ratio=(46+88)/(46+237)=47%

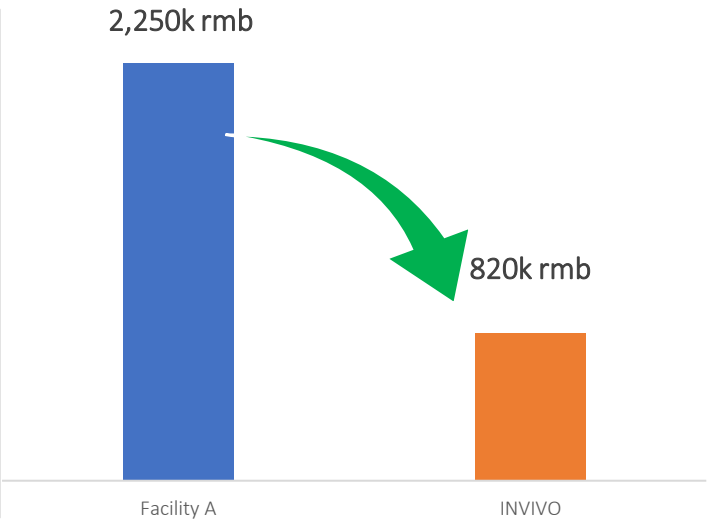
案例 01 – Invivo体内筛选平台（动物房） Case Study 01 – Invivo Animal Facility

新风量: 34,000 CMH (air flow)

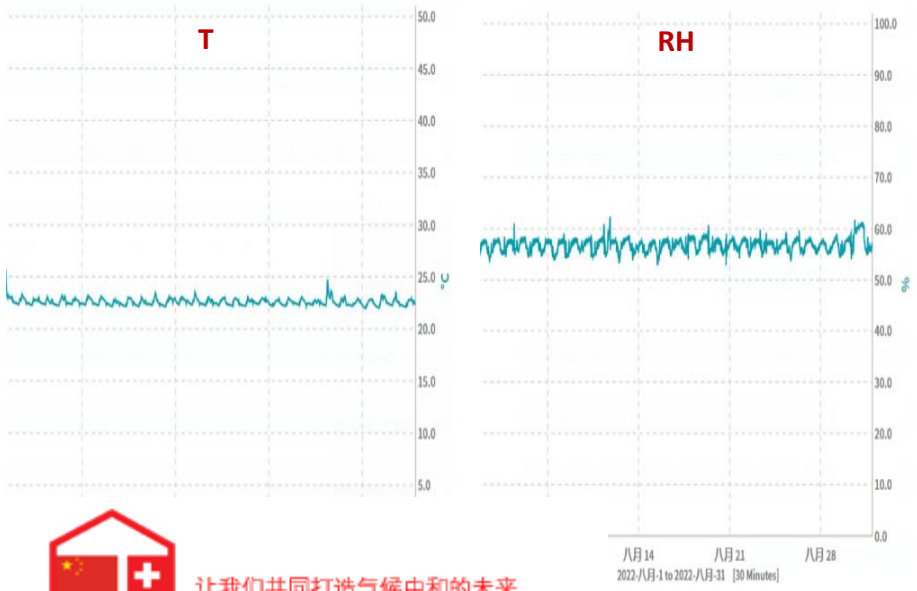
年度电费: 820 rmb (energy bill)

运维人员: 0.25 FTE (people)

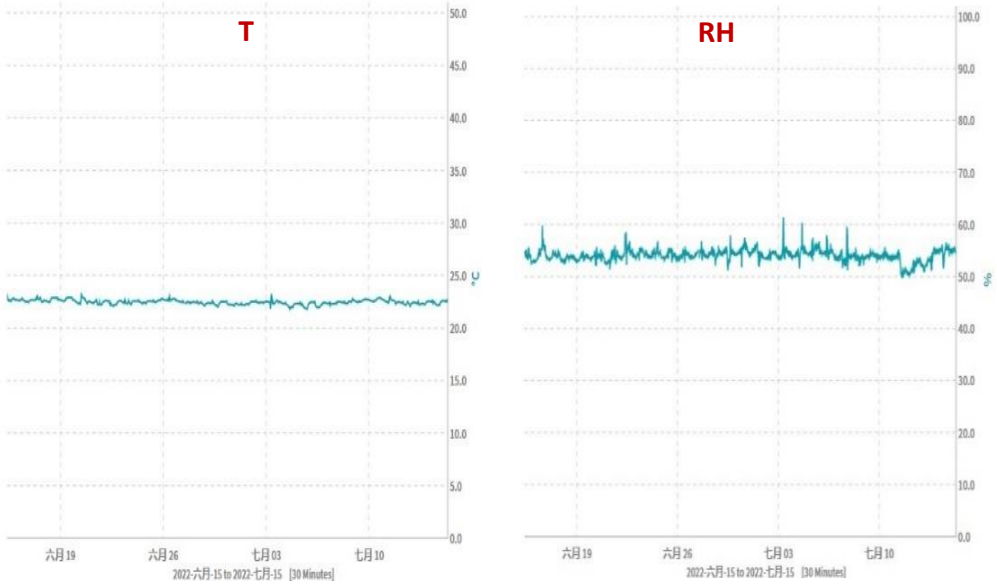




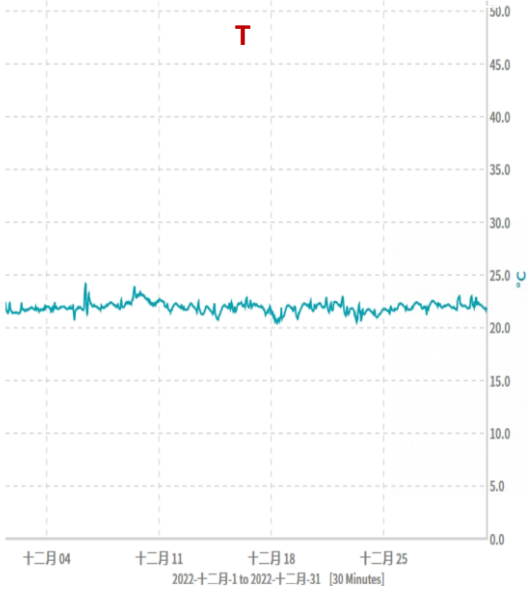
夏季 summer



雨季 raining season

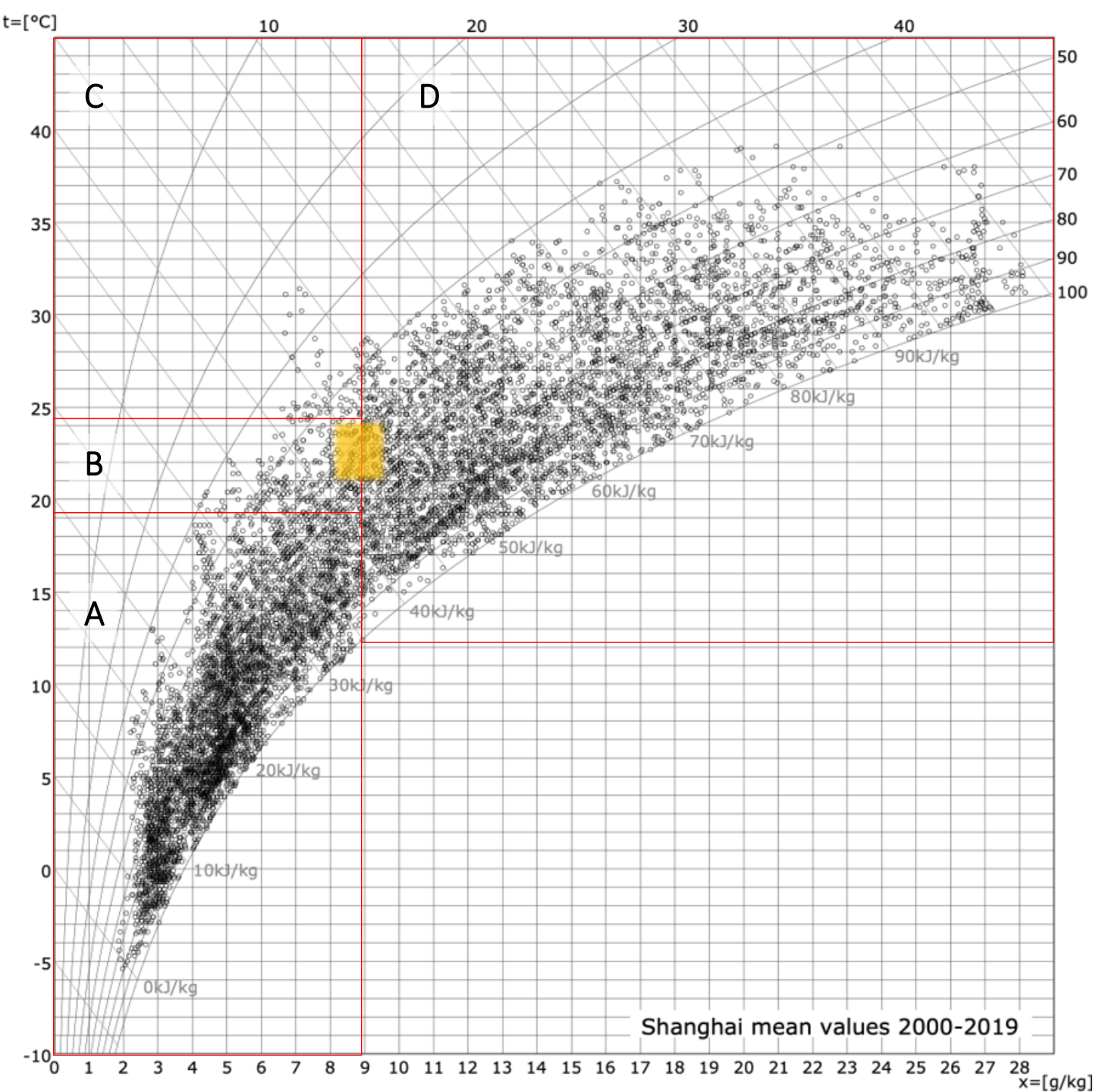


冬季 winter

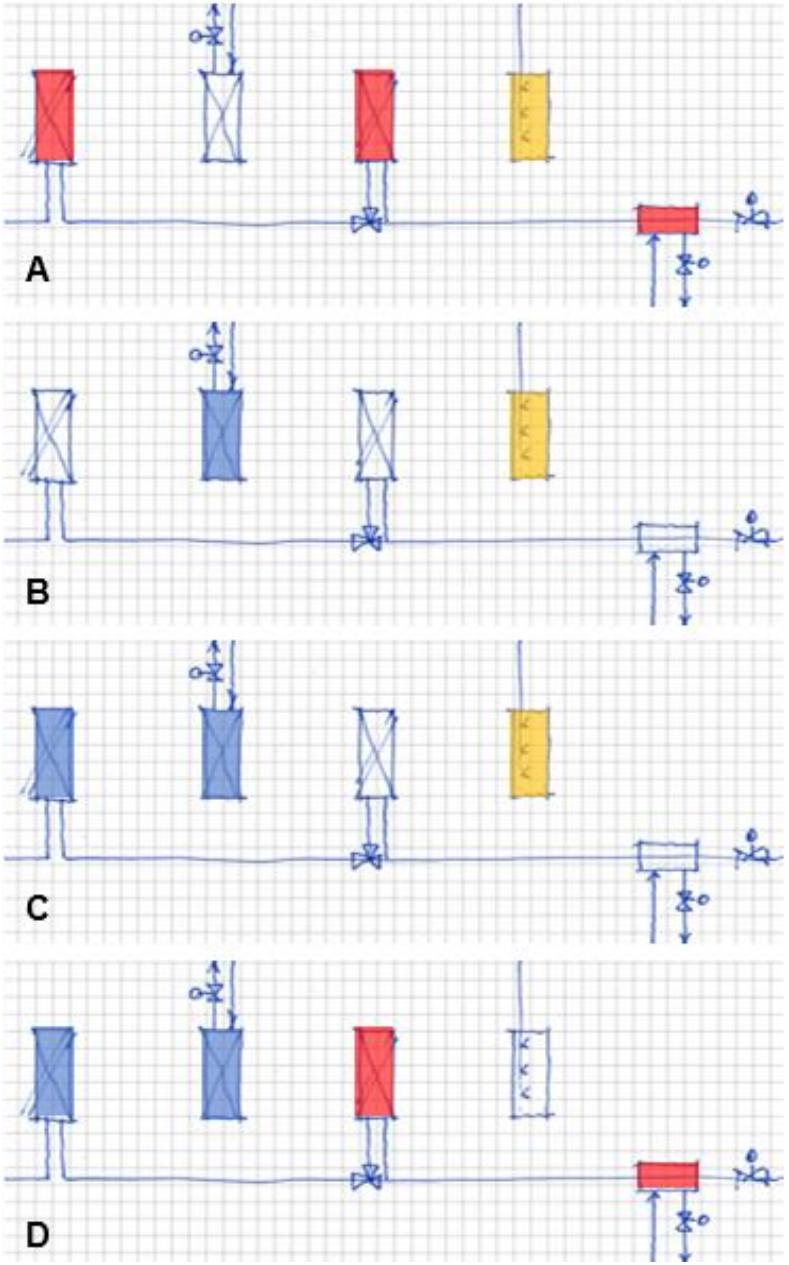


ZEB

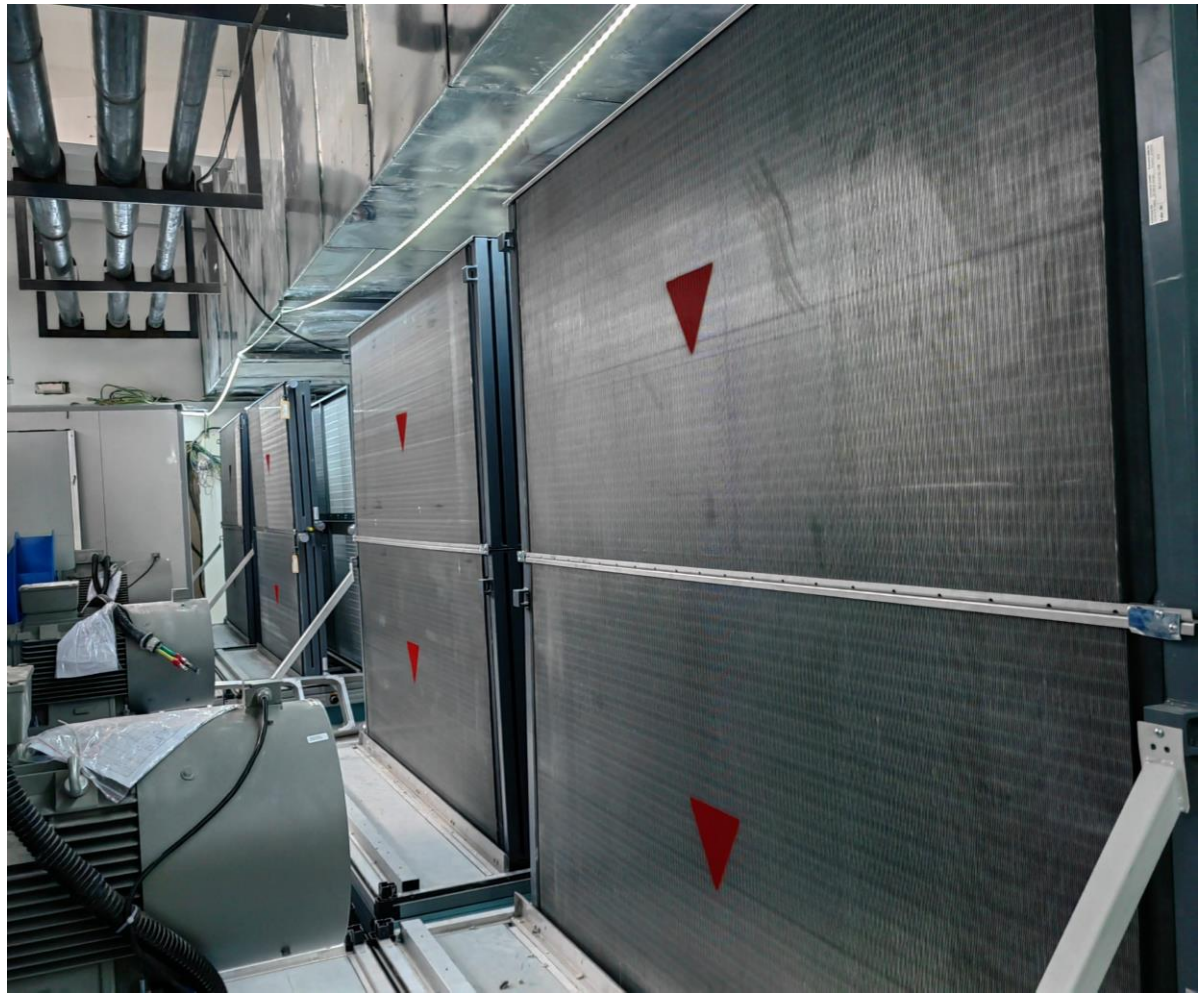
让我们共同打造气候中和的未来
Building a climate-neutral future together


t=[°C]
x=[g/kg]
C
D
B
A
0kJ/kg
10kJ/kg
20kJ/kg
30kJ/kg
40kJ/kg
50kJ/kg
60kJ/kg
70kJ/kg
80kJ/kg
90kJ/kg
Shanghai mean values 2000-2019

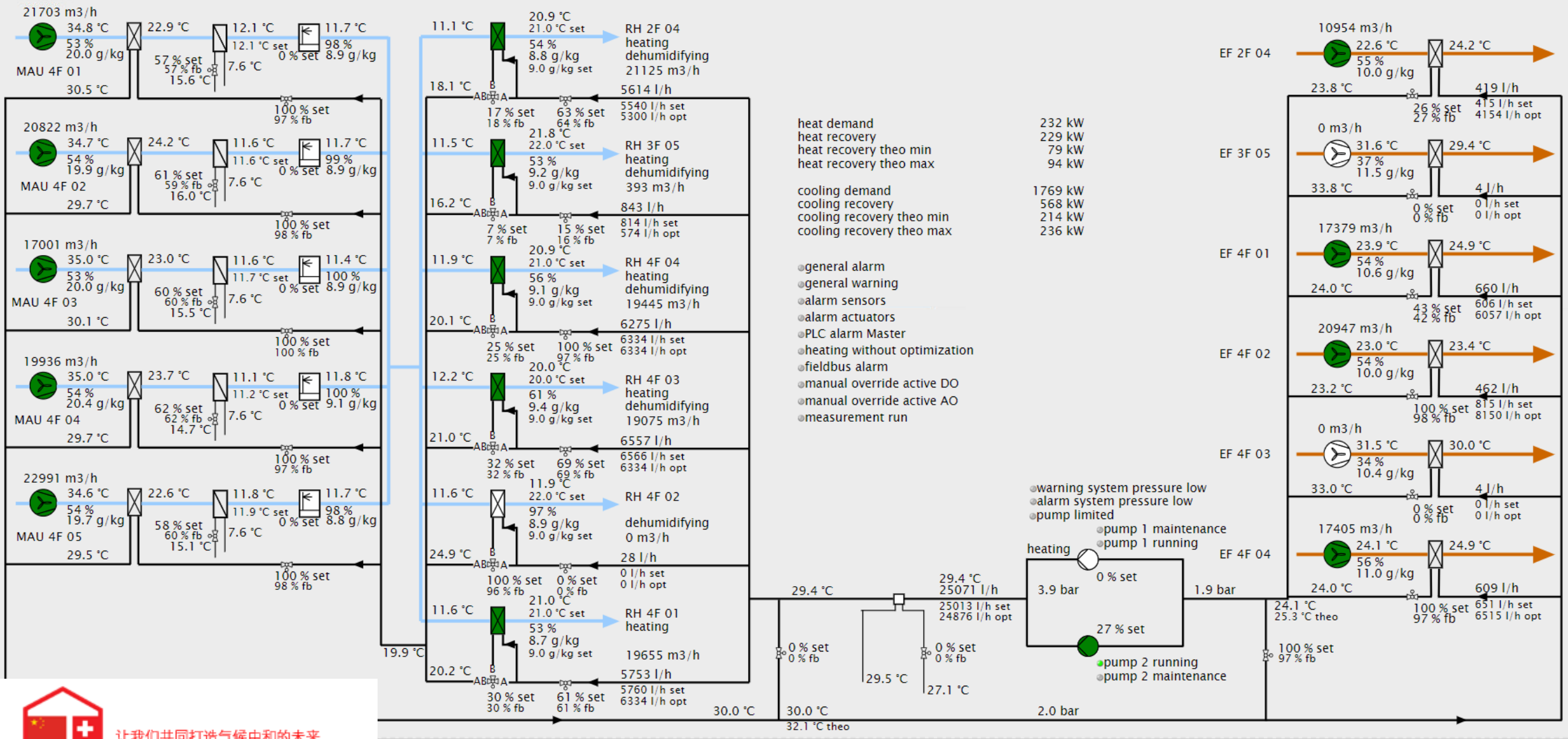
konvekta


A
B
C
D

案例 02 – 维通利华(Charles River)动物饲养基地 Case Study 02 – Charles River



案例 02 – 维通利华(Charles River)动物饲养基地 Case Study 02 – Charles River



其他案例 References

konvekta

Novartis Campus
上海

运行 2014

6,883,430 kwh
热量需求

3,758,352 kwh
热量回收

54.6%
年度热回收效率

罗氏研发中心
上海

运行 2019

1,313,001 kwh
热量需求

1,235,153 kwh
热量回收

94.1%
年度热回收效率

汉高 ICS A
上海

运行 2020

992,730 kwh
热量需求

986,002 kwh
热量回收

99.3%
年度热回收效率

深圳湾实验室
深圳

运行 2022

479,788 kwh
热量需求

341,088 kwh
热量回收

71.0%
年度热回收效率

科莱恩化学
上海

运行 2020

6,474,000 kwh
热量需求

3,819,660 kwh
热量回收

59.0%
年度热回收效率

ZEB

让我们共同打造气候中和的未来
Building a climate-neutral future together

合作 References

konvekta

让我们共同打造气候中和的未来
Building a climate-neutral future together

让我们共同打造气候中和的未来
Building a climate-neutral future together

中华人民共和国
住房和城乡建设部

IBE环能科技
中国建筑节能协会

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

intep
skat Swiss Resource Centre and Consultancies for Development

感谢您的关注!

THANK YOU!

提问环节

YOUR QUESTIONS?