TIMEPAC Academy

Session 6

Re-Co and BACS

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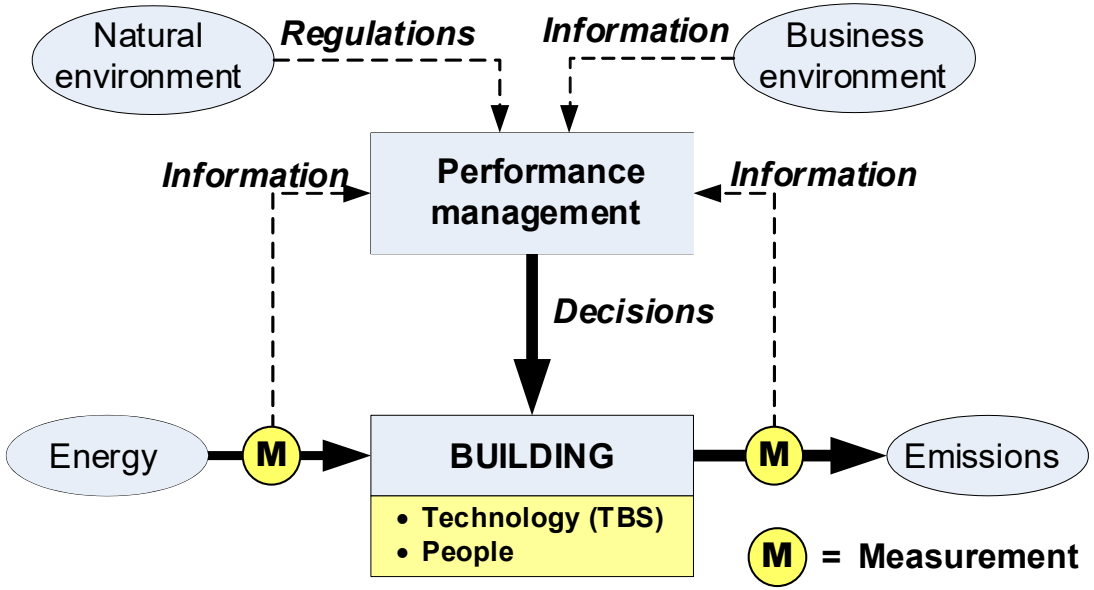
GOLEA

Energy management systems vs Process control systems

- In many modern buildings **different monitoring and control systems are used**, but majority of them are **not directly connected with the energy consumption optimization**
- The reference architecture of any energy management system evolved from the traditional management structure, **plan-do-check-act model**
- Process control systems provide the **energy data but also contextual information about energy use** – key element for proper decision making
- Building Automation and Control System (BACS) evolved from the **merging of different areas of automation**, for example **Energy management system** and **Process control system**

Wider context of performance monitoring system

- **Performance monitoring system is part of larger Building Automation and Control System (BACS)** and includes a supportive IT infrastructure and provide a framework for data:
  - Analysis
  - Interpretation
  - Knowledge creation
  - Learning
  - Communicating results and lessons learned



Matrix for properly defining needs regarding metering and sensor infrastructure (1/2)

- The **selection** of measurement points and number of sensor to be deployed must be **simple and understandable to energy manager/final user**

- Measuring infrastructure **must be defined and afterwards evaluated according to process control requirements and performance category monitored** (for example measuring infrastructure and sensors for HVAC system for data room are different from those used for general HVAC system)

- **Price of new equipment (including maintenance)** in combination with **data reliability, relevance for process control and performance monitoring** are of highest importance for the selection of measurement devices and sensors

Matrix for properly defining needs regarding metering and sensor infrastructure (2/2)

- **Single data source** can support information needs for **monitoring multiple process and various performance objectives**

- For purposes of effectiveness and economics and to avoid overlapping and confusion, it is important at the outset of **BACS design** to anticipate **various potential users of data items from a single source**

- Don‘t forget that you need to analyse the collected data to **understand the relationship between energy consumption and operational settings**. During the Re-Co activities you must **look for patterns such as increases in energy usage** due to changes in HVAC operation, lighting, or occupancy levels

Evaluation of metering infrastructure – purpose and key elements

- **Evaluation of metering infrastructure** must assure that acquired data will serve as a good basis for **process control and identifying performance improvement opportunities**

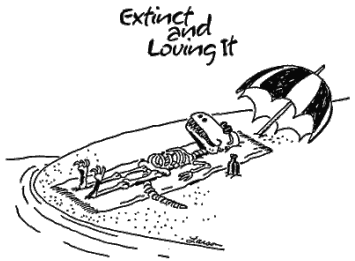
- Evaluation of metering infrastructure must **provide answers on following questions**:
  - Why do we **need** selected measuring point/sensor?
  - What are the **costs** of deployment and future maintenance?
  - What energy **indicators** will be calculated based on selected measuring points/sensors?
  - What is the appropriate **data recording frequency**? (Be aware that excessive and frequent data recording can overload operators with analyses requirements)

Implementation approach

- Planning a proper **evaluation of the metering infrastructure and sensors** includes at least the following:
  - Lay out a **timetable and scope of all activities**
  - Set-up the **project team and assign specific tasks**
  - Establish a relationship with the **building's management and technical personnel**
  - Establish effective lines of **communication** and co-ordination between the **project team and technical personnel**
  - **Validation** of acquired data
  - **Performance** analysis
  - Proposal of **corrective actions**
  - **Monitoring and verification**

Monitoring and verification of data

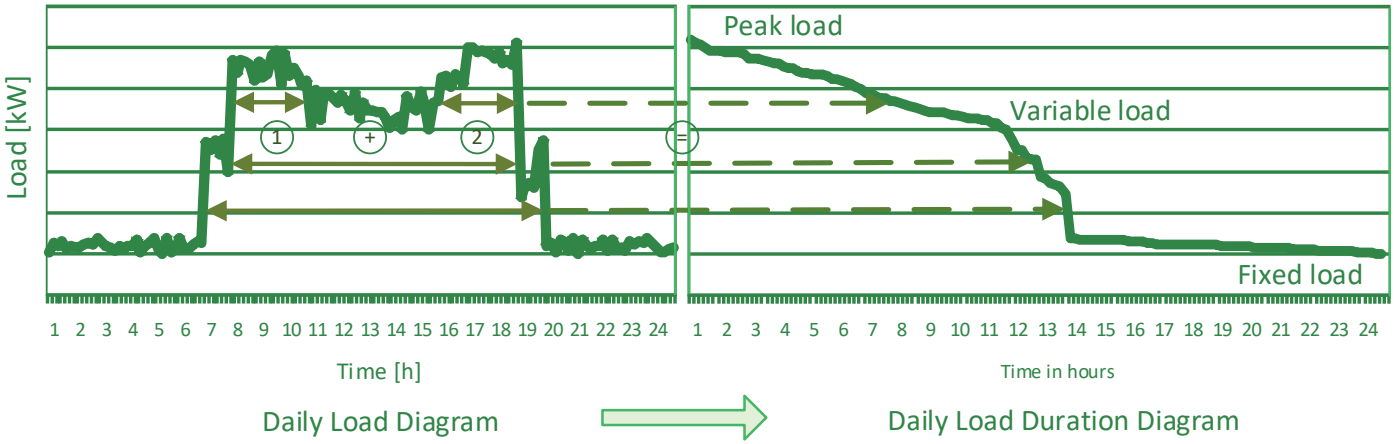
- **Data handling routines** have to be specified in order to **assure data adequacy**
- **Data verification procedure** have to be established to assure that **recorded values are correct**
- **Key question for the successful deployment: Always ask yourself is this value really correct?**

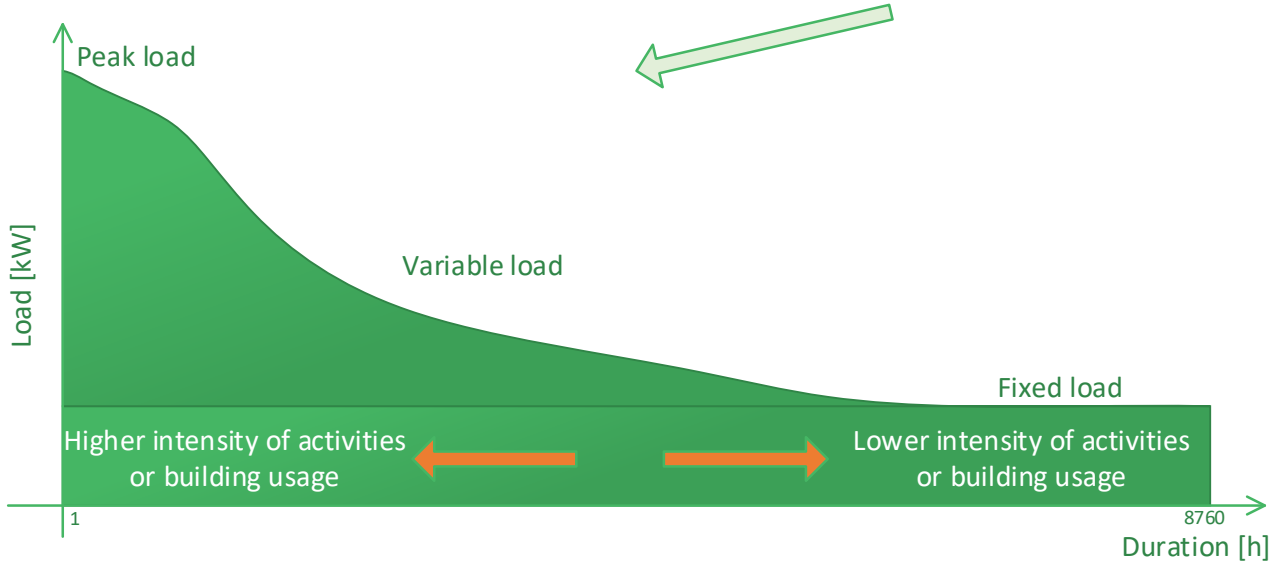


Data verification procedure

- Always **conduct data verification procedure** as follows:
  - Check **accuracy of reading and recording**
  - Consistency check (make sure that the **same values** are applied across **all performance indicators**)
  - **Units check** (make sure that the figures entered into database are associated with proper units)
  - **Compare related data** – for example compare electricity consumption figures from utility electricity bills with the company's recording of kWh directly from the electricity meter
  - Check the **expectancy range** - each value that is monitored over a period of time appears within certain data range. If the recorded value is unexpectedly high or small (outside expected range), this indicates an error.
  - From time to time (i.e., 6 month intervals), carry out an **independent check of the whole data handling procedure**

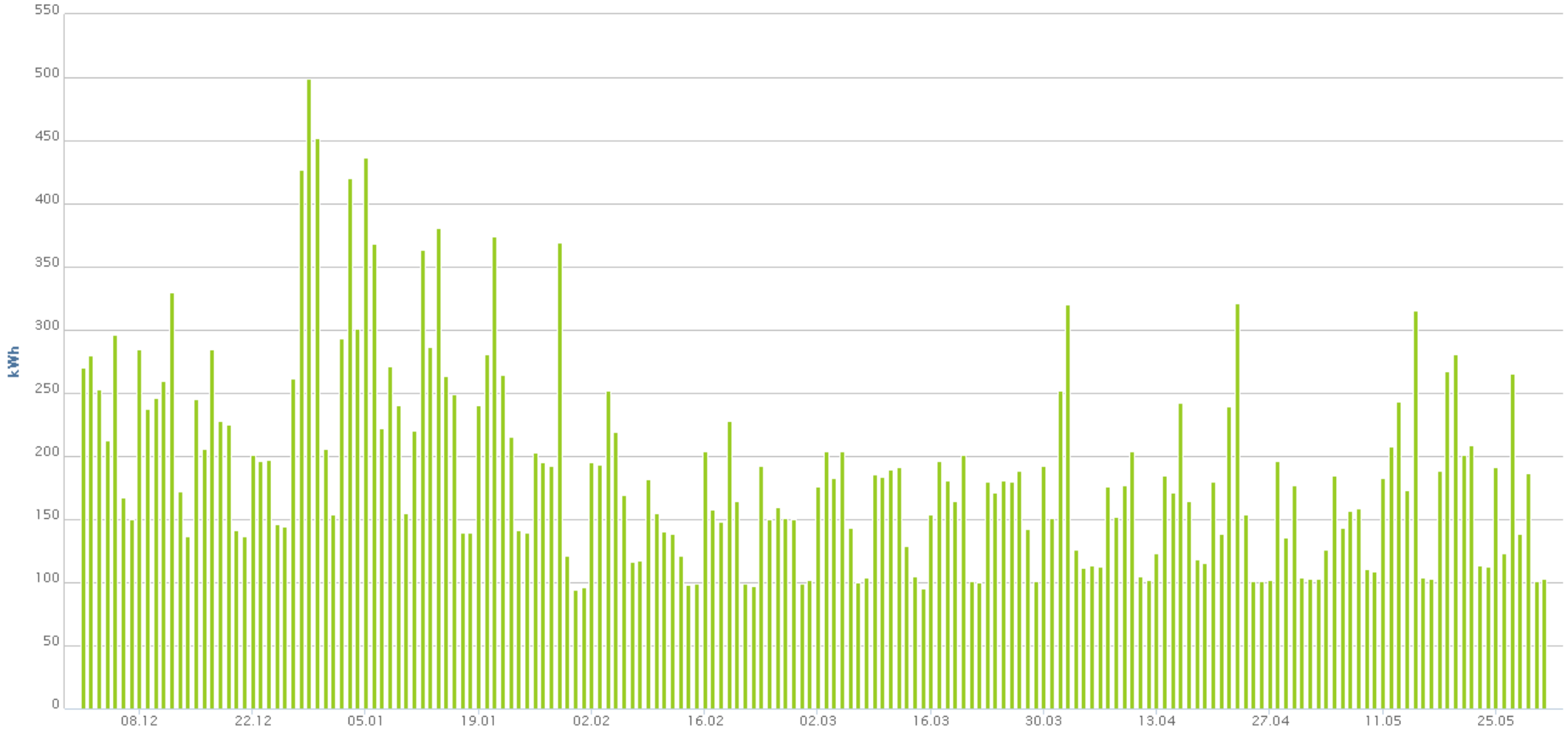
Optimization (1/4)



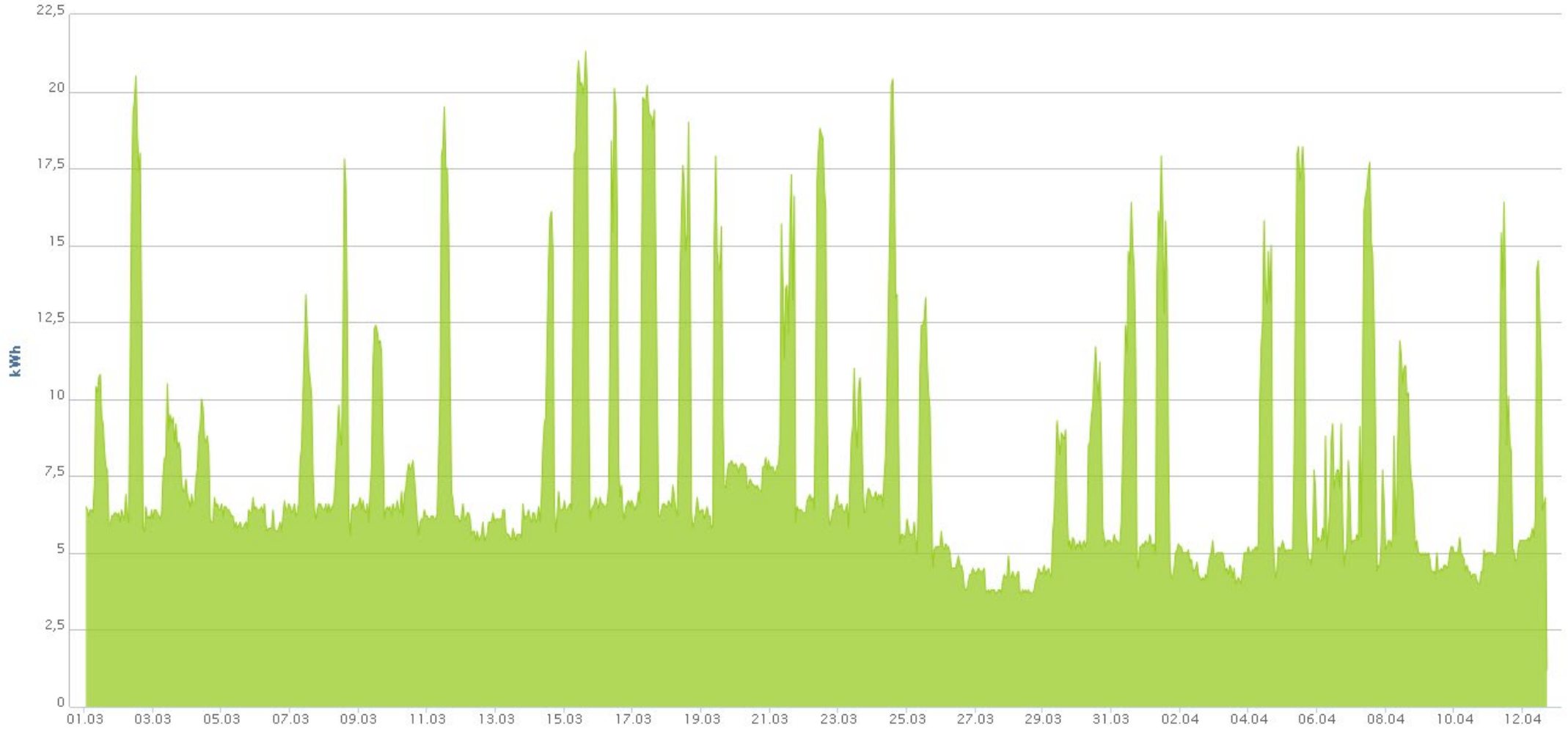


Annual Load Duration Diagram

Optimization (2/4)



Optimization (3/4)



Optimization (4/4)

Datum	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	00:00
1.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
3.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
4.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	112%	105%	107%	100%	100%	100%	100%	100%	100%	100%	100%
5.5.2015.	100%	100%	100%	100%	100%	100%	100%	114%	100%	118%	113%	108%	107%	102%	102%	100%	100%	100%	100%	100%	100%	100%	100%	100%
6.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	119%	114%	105%	108%	100%	100%	100%	100%	100%	100%	100%	100%	100%
7.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	111%	122%	100%	123%	105%	110%	115%	100%	111%	100%	100%	100%	100%	100%	100%	100%
8.5.2015.	100%	100%	100%	100%	100%	100%	101%	102%	100%	127%	111%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
9.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
10.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
11.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	105%	105%	124%	100%	110%	120%	100%	110%	108%	107%	101%	100%	100%	100%
12.5.2015.	100%	100%	100%	100%	100%	100%	100%	118%	100%	119%	100%	112%	114%	100%	112%	100%	100%	100%	100%	100%	100%	100%	100%	100%
13.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	105%	100%	100%	100%	110%	110%	100%	109%	128%	138%	136%
14.5.2015.	140%	139%	100%	144%	145%	137%	100%	130%	154%	142%	105%	138%	137%	126%	100%	100%	101%	116%	106%	100%	126%	118%	100%	122%
15.5.2015.	121%	100%	118%	127%	100%	108%	123%	110%	100%	100%	100%	100%	100%	100%	100%	100%	107%	108%	105%	143%	136%	100%	137%	136%
16.5.2015.	111%	135%	143%	137%	106%	147%	143%	100%	145%	145%	111%	125%	146%	141%	101%	139%	143%	142%	100%	149%	143%	100%	142%	145%
17.5.2015.	142%	100%	139%	143%	130%	110%	141%	145%	115%	122%	144%	142%	100%	139%	146%	119%	118%	141%	145%	100%	141%	147%	141%	100%
18.5.2015.	133%	133%	138%	104%	123%	135%	137%	127%	145%	133%	136%	124%	125%	132%	130%	118%	100%	121%	142%	130%	102%	141%	144%	112%
19.5.2015.	124%	143%	148%	116%	123%	139%	146%	140%	142%	135%	115%	123%	119%	106%	119%	106%	145%	124%	116%	105%	105%	120%	100%	119%
20.5.2015.	100%	120%	100%	121%	100%	119%	100%	104%	100%	100%	110%	119%	104%	115%	105%	112%	144%	114%	100%	100%	102%	102%	103%	100%
21.5.2015.	101%	101%	102%	102%	103%	100%	103%	100%	100%	100%	100%	100%	100%	100%	105%	205%	135%	100%	100%	100%	100%	100%	100%	100%
22.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	102%	101%	100%	100%	100%	107%	100%	100%	105%	100%	100%	100%	100%	100%
23.5.2015.	100%	102%	100%	100%	100%	100%	100%	100%	100%	100%	101%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
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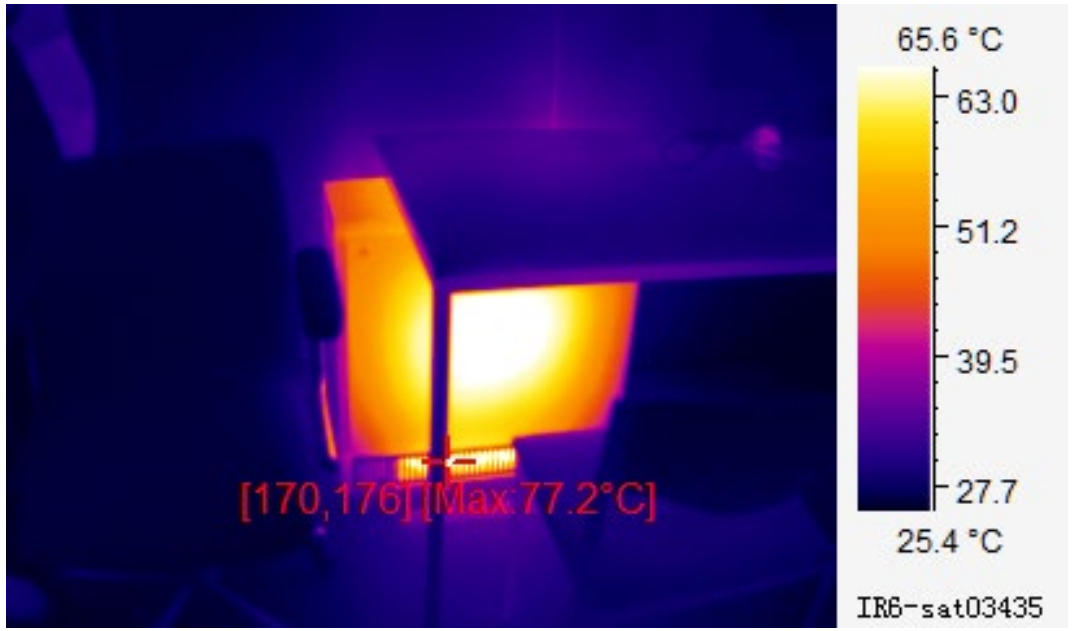
25.5.2015.	100%	100%	100%	100%	100%	100%	102%	100%	106%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
26.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
27.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
28.5.2015.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	102%	100%	100%	100%
29.5.2015.	101%	101%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
30.5.2015.	102%	104%	100%	100%	104%	103%	100%	100%	101%	100%	101%	100%	103%	100%	100%	101%	100%	100%	103%	101%	100%	102%	100%	103%
31.5.2015.	101%	104%	100%	100%	104%	102%	100%	103%	100%	100%	101%	100%	102%	100%	101%	102%	100%	100%	104%	102%	100%	103%	100%	104%



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If you would like more information, please visit www.timepac.eu or contact us at

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