Power consumption and energy efficiency potentials in data centres: a case study from Switzerland

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Introduction

Motivation

- Significant energy demand in data centres (DC)
  - 2.7% of power consumption in EU (2018)
  - 2.8% of power consumption in CH (2013)
- Significant efficiency potential has been observed in the past
- Further power demand increase expected

Goals

1. To identify **power consumption** of Swiss DC in 2019
2. To estimate the remaining **energy efficiency** potential
3. To analyse past and present future developments in the (Swiss) DC market

Online-survey

- Online-Survey of a stratified sample in Switzerland for three different segments

| A: DC service provider (57)	B: In-house DC (> 2000)	C: smaller server rooms in SME (> 500)

- Response rates between 22%-39%

- Questions on
  - Power consumption
  - Installed IT capacity
  - Power usage effectiveness (PUE)
  - DC infrastructure: cooling method, system temperature, etc.
  - IT infrastructure: number of server, utilisation, storage types, backup systems, etc.

Status quo energy efficiency in Swiss data centres
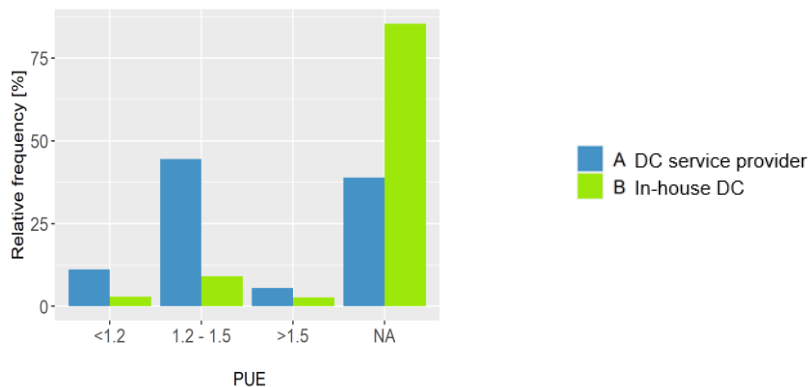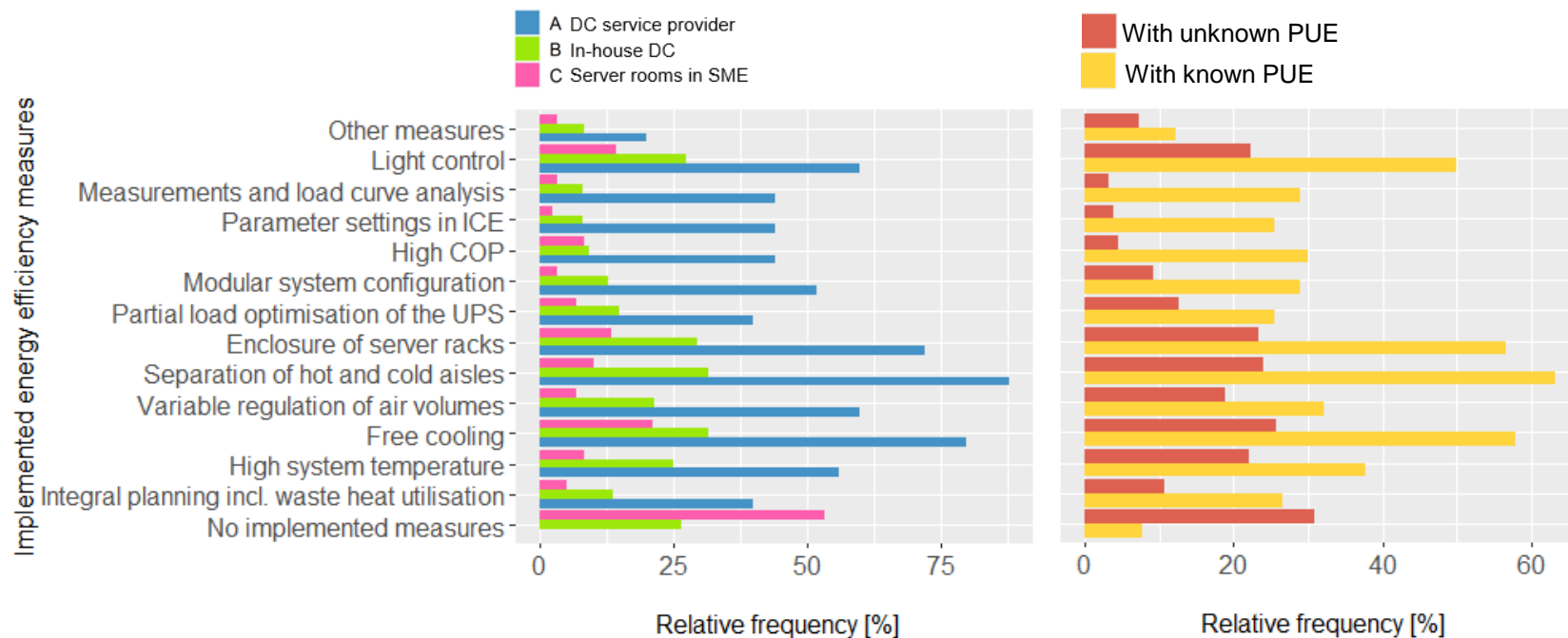

Power usage effectiveness (PUE)

- $\dfrac{Total\ Energy\ DC}{Energy\ IT}$

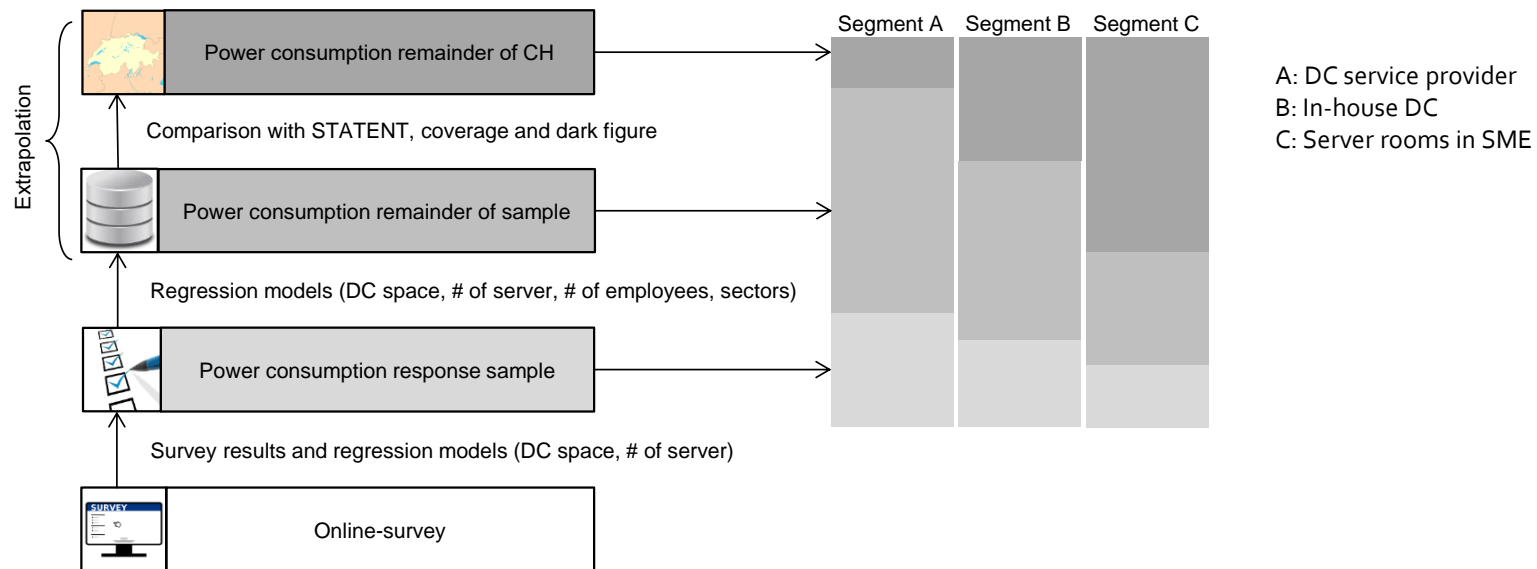- The closer to 1, the more efficient the DC is!
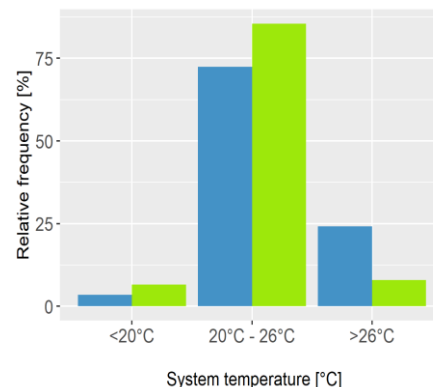
System temperature

- Differences between segments

- Important to increase days with free-cooling!

Status quo energy efficiency in Swiss data centres

Power consumption

Methodology

Extrapolation

Power consumption remainder of CH

Comparison with STATENT, coverage and dark figure

Power consumption remainder of sample

Regression models (DC space, # of server, # of employees, sectors)

Power consumption response sample

Survey results and regression models (DC space, # of server)

Online-survey

Segment A   Segment B   Segment C

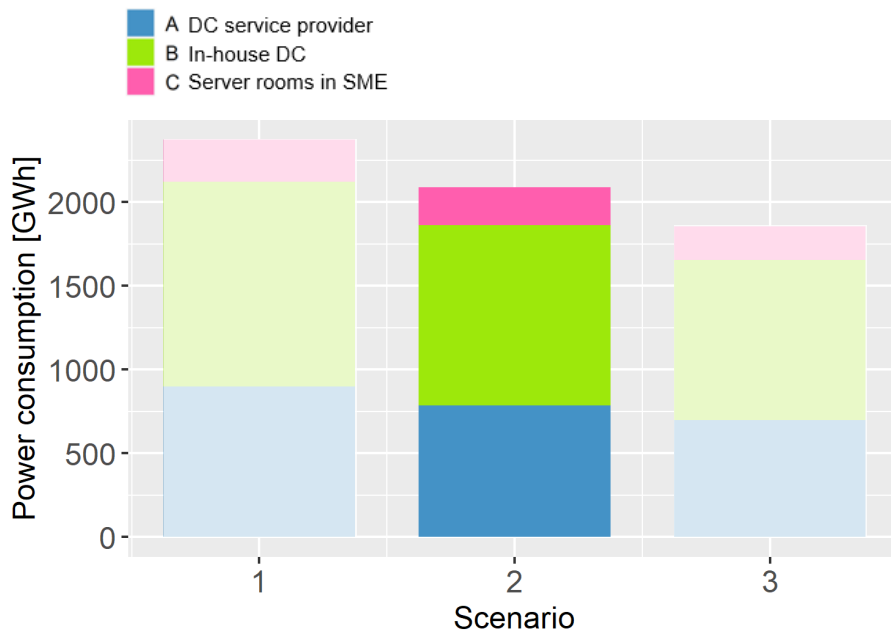A: DC service provider
B: In-house DC
C: Server rooms in SME

Power consumption

Results

- About 2.1 TWh of power consumption

- 3.6% of Swiss power consumption in 2019

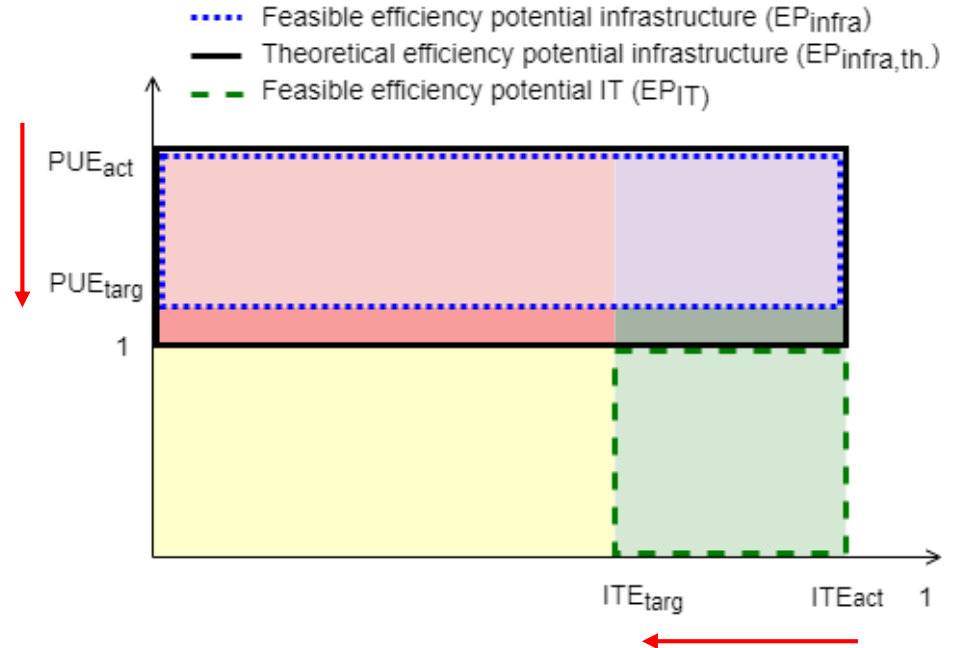- Substantial consumption in in-house DC
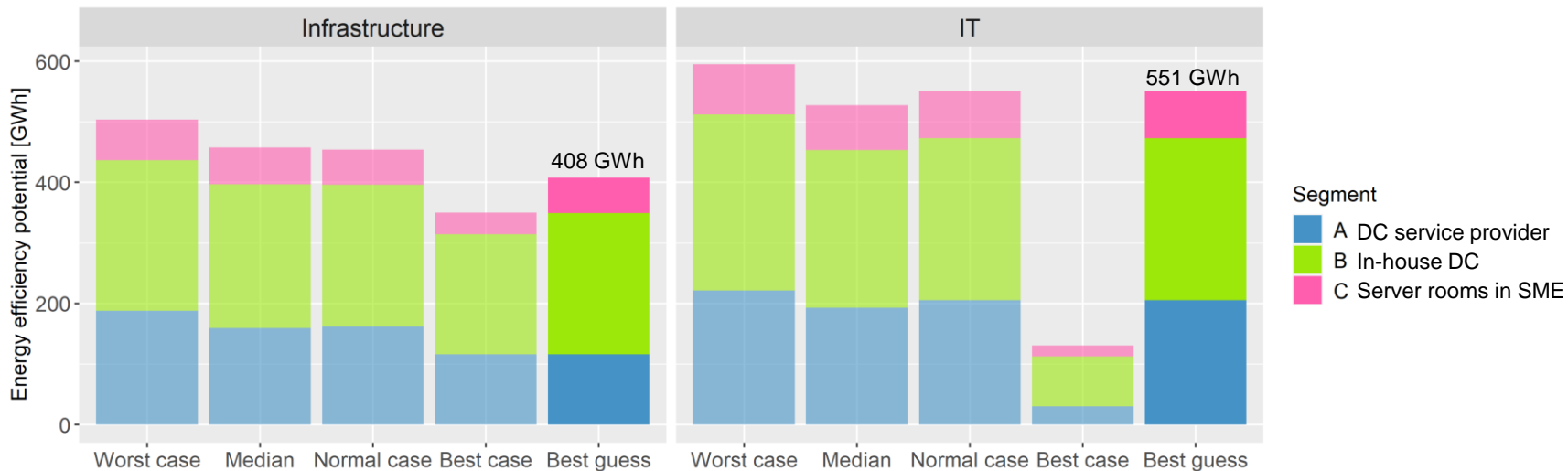
Efficiency potential

Methodology

Survey data

- DC infrastructure: cooling method, system temperature, etc.

- IT infrastructure: utilization, storage types, backup-systems, etc.

- Estimation of actual
  - PUE (> 1)
  - IT Efficiency Indicator (ITE): 0.5-1

····· Feasible efficiency potential infrastructure (EP_{infra})
—— Theoretical efficiency potential infrastructure ($EP_{infra,th.}$)
– – Feasible efficiency potential IT (EP_{IT})

PUE_{act}
PUE_{targ}
1
ITE_{targ} ITE_{act} 1

Efficiency potential

Results

- DC infrastructure: 408 GWh (20%)
- IT Infrastructure: 551 GWh (26%)

Total efficiency potential of about 46%!

Discussion

Past development

- Moderate increase since 2013 in power consumption
- Switzerland still above average

Drivers for demand increase

- New trends such as IOT, big data, cloud computing etc.
- Large public cloud providers entering Swiss Market
  (e.g. Microsoft, Oracle, Amazon etc.)
- Many planned projects (Zurich and around lake Geneva)

Conclusion

Policy implications

- to inform, educate and train planners, investors, and operators of new and existing data centres

- PUEDA+ promotion programme

- SDEA efficiency label

- **Future work should focus on**

- Considering further IT measures

  (e.g. quality of power supply, intelligent switches)

- Customers of DC service providers

Thank you for your interest!

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Literature

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