Energy Efficiency and EU Policy affecting Data Centres

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Outline

Background *– State of the EU DC sector based on findings from the EURECA project*

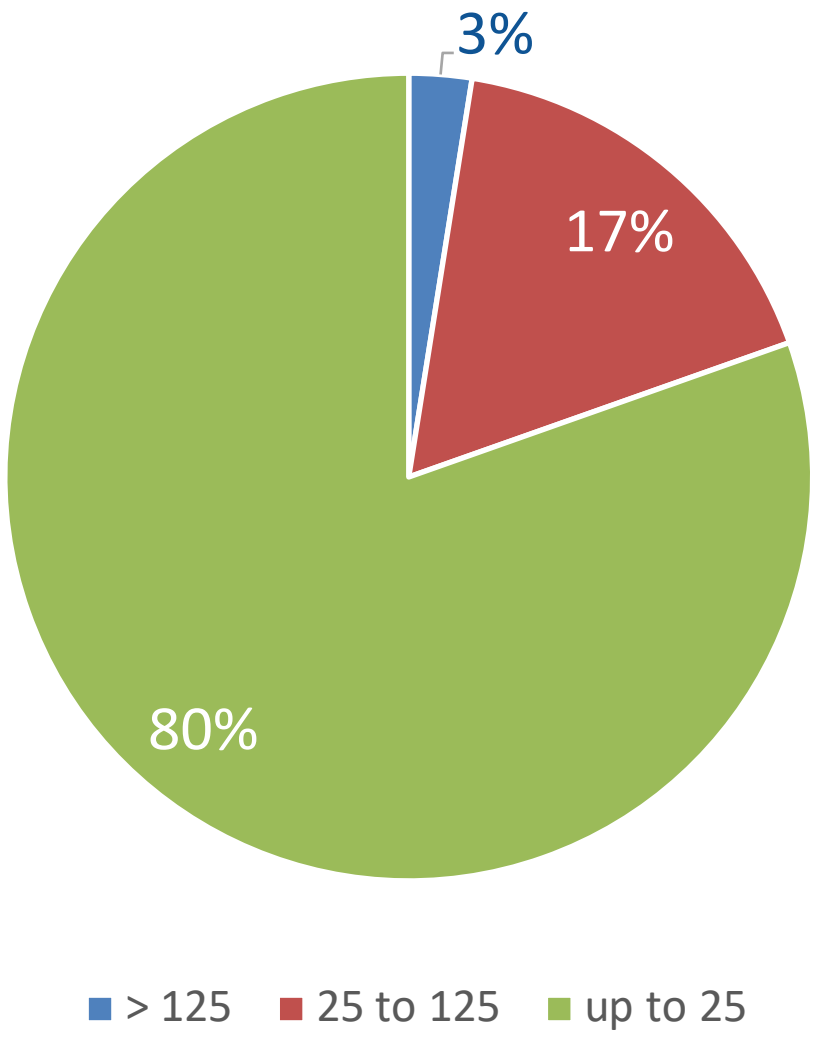
Ecodesign Regulation *on servers and data storage products*

Wider EU initiatives *towards digital and sustainable society*

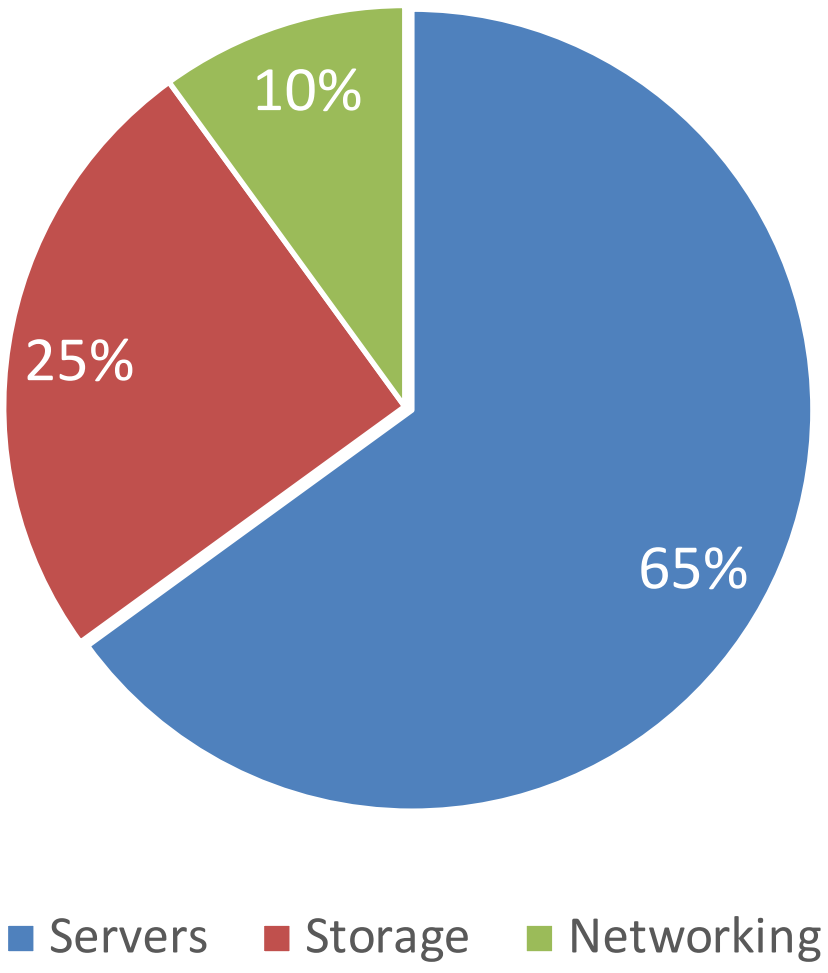
Panel Discussions

Data Centre Energy Consumption Trends

In Europe,25% increase over 3 years



Data centre size (in racks)

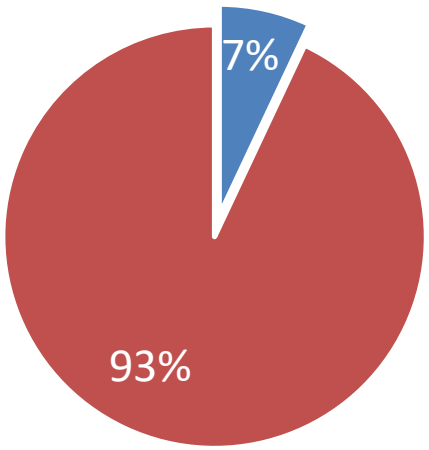


Energy Consumption breakdown by IT Equipment type

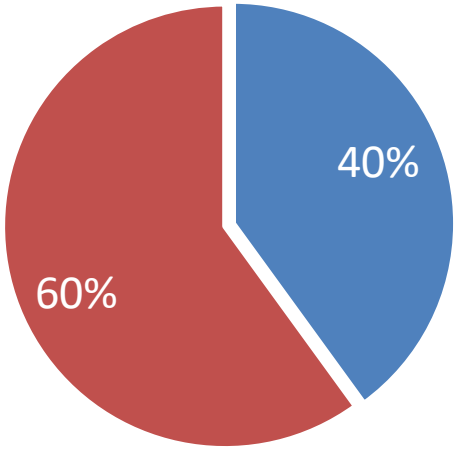
Power Usage Effectiveness (PUE)

Server Distribution

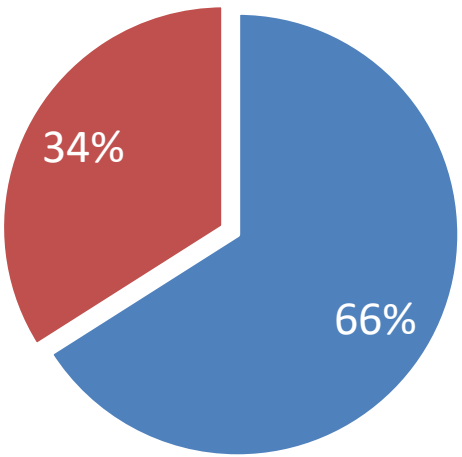
Compute Capacity



Age



Energy Consumption



> 5 years old

	Scenario	PUE	β	Annual Use Phase Energy in KWh (for running workload ω)					
				Hardware 1 (7.5Y old)	Hardware 2 (6Y old)	Hardware 3 (4.5Y old)	Hardware 4 (3Y old)	Hardware 5 (1.5Y old)	Hardware 6 (Current)*
On-Premise (non-virtualised)	Worst	3	5%	51,372,685	15,414,061	12,840,312	6,257,229	2,453,698	2,093,779
	Average	2	10%	17,708,754	5,533,001	4,617,433	2,356,780	952,302	820,422
	Best	1.5	25%	5,838,699	2,015,383	1,688,826	950,967	406,652	356,373
Colocation (non-virtualised)	Worst	2.5	5%	42,810,571	12,845,052	10,700,260	5,214,358	2,044,749	1,744,816
	Average	1.8	10%	15,937,879	4,979,702	4,155,690	2,121,102	857,072	738,380
	Best	1.3	25%	5,060,206	1,746,666	1,463,650	824,172	352,433	308,857
On-Premise (virtualised)	Worst	3	6%	43,102,834	13,042,542	10,868,925	5,349,876	2,111,950	1,806,064
	Average	2	30%	6,682,286	2,370,976	1,988,917	1,146,976	496,637	436,802
	Best	1.5	60%	2,944,252	1,185,352	998,841	633,394	287,041	255,673
Private Cloud	Worst	2.5	7%	30,996,498	9,457,166	7,883,993	3,918,139	1,556,537	1,333,795
	Average	1.8	30%	6,014,058	2,133,878	1,790,026	1,032,279	446,974	393,122
	Best	1.3	60%	2,551,685	1,027,305	865,662	548,941	248,769	221,583
Public Cloud	Worst	2	7%	24,797,198	7,565,733	6,307,194	3,134,511	1,245,229	1,067,036
	Average	1.5	40%	3,977,983	1,481,792	1,245,265	746,813	329,759	291,637
	Best	1.1	70%	1,942,527	807,147	680,852	440,725	201,546	179,958

* *As of 2016*

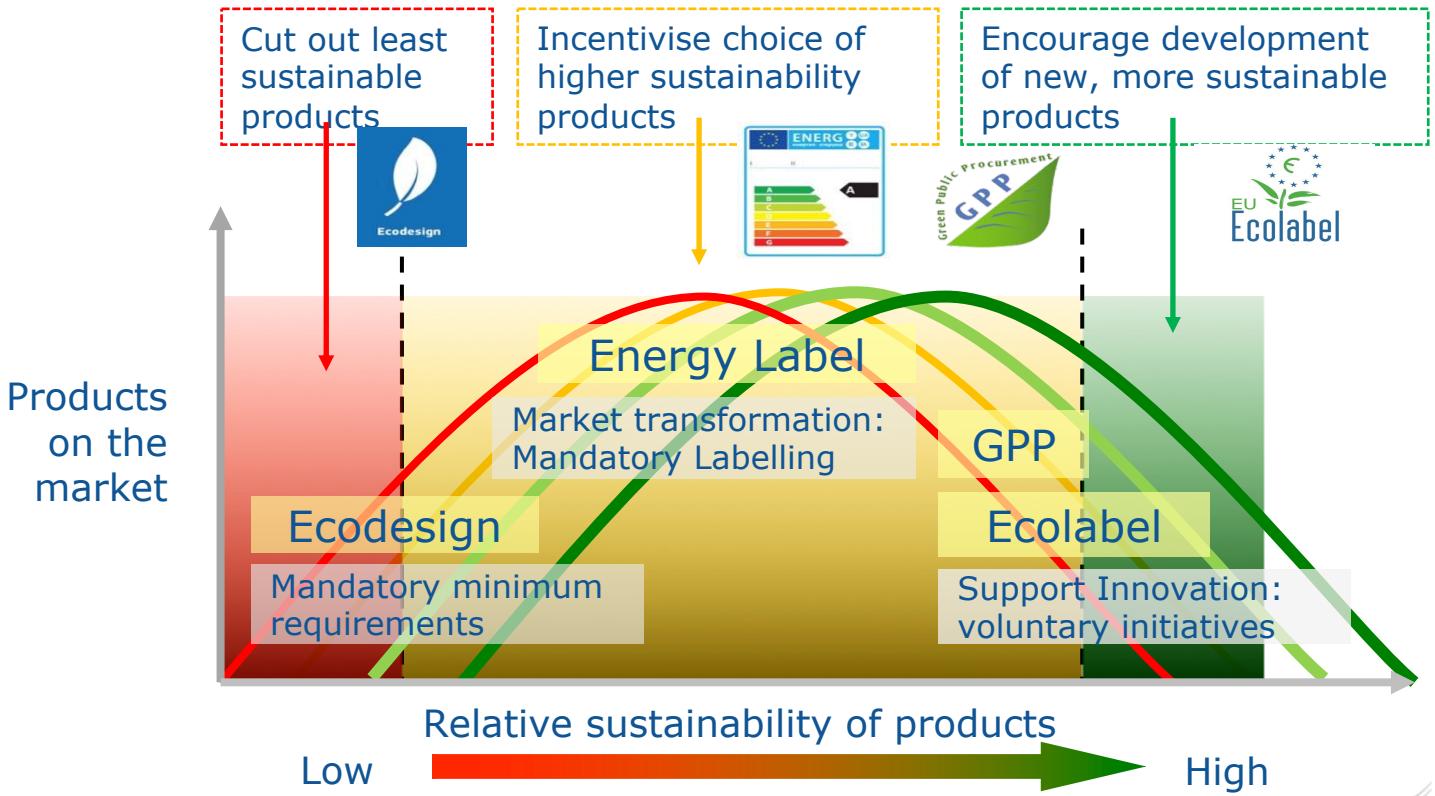
Source: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8263130

Server Utilisation

Points affecting server utilisation

- Active – Active / clustering deployments
- Peak utilisation vs performance degradation
- Ensuring there is enough capacity in the system to cater for workload peaks
- Having the right server configuration for the workload

The Ecodesign Regulation on servers and data storage products


Cut out least sustainable products
Incentivise choice of higher sustainability products
Encourage development of new, more sustainable products
Ecodesign
Green Public Procurement GPP
EU Ecolabel
Products on the market
Energy Label
Market transformation: Mandatory Labelling
GPP
Ecodesign
Ecolabel
Mandatory minimum requirements
Support Innovation: voluntary initiatives
Relative sustainability of products
Low
High

- *An Ecodesign Regulation on servers and data storage products has been recently voted by European Union (EU) Member States*
- *It aims to reduce, in a sustainable way, the environmental impact on these products in the EU market*
- *It contains requirements (as of 03/2020) on:*
  - *A. Energy Efficiency aspects (maximum idle power consumption, minimum server efficiency in active state, minimum efficiency of the power supply unit, information requirements on product operating conditions and on idle power at higher temperature)*
  - *B. Material efficiency aspects*

Lot 9 Mat. eff. req.

- Servers and data storage products show good examples of refurbishment practices, take-back schemes, etc..

- The proposed requirements aim to overcome a few barriers and further improve the Circular Economy of these product in a sustainable way for businesses:

1. Design for disassembly

2. Secure data deletion of reusable data storage equipment.

3. Securing that firmware updates for product are available for repairers.

4. Critical raw material information requirement.

Scope - servers

Servers with up to four processor sockets, including among others: Tower servers, rack servers, blade servers, multi-node servers, resilient servers etc.

Tower Server

Rack-mounted Server

Multi-node Server

Server appliance

*** Note that these are pictorial representations, actual products may differ.**

Scope - storage

European Commission

Online 2, 3 and 4 data storage products

Online 2

Online 3

Online 4

***Online 1-6 products are based on Online classification by SNIA Emerald.**
****Note that these are pictorial representations , actual products may differ.**

Towards a digital and sustainable society

A European Commission perspective

Political context

- Paris Agreement & EU sustainability objectives
- Strong cross-border dimension of the cloud
- Contributing to the Sustainable Development Goals

EU sustainability targets compared to 1990 levels:

	2020	2030	2050
Decrease in GHG emissions	20%	40%	80-95% (100% for energy sector)
Renewable energy	20%	27->35%	75-97%
Improvement in Energy efficiency	20%	27->35%	41% (vs 2005-6 peak)

Digitalising of society

European Commission

Micro-electronics

Autonomous driving

Smart Energy

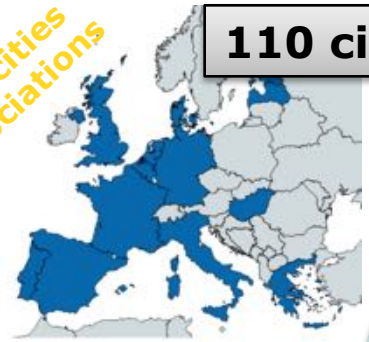
Interoperability and standardisation The Urban Platform

European Commission

European Innovation Partnership on Smart Cities and Communities

110 cities

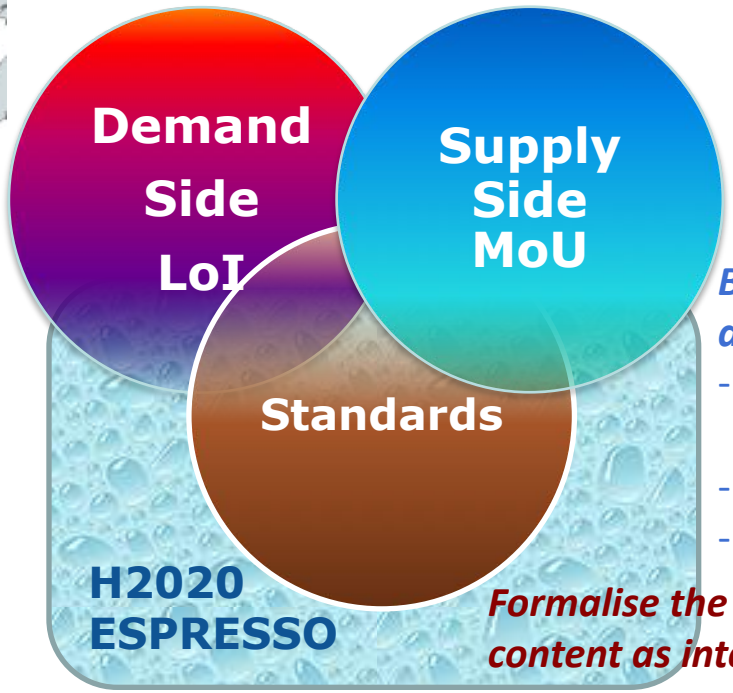
Individual cities plus associations



Urban Platform

Accelerate the adoption of Urban Platforms in EU cities

93 signatories



Agree common requirements, and speed adoption

- ***Requirements***
- ***Leadership guide***
- ***Management framework***

Bring together EU Industry to adopt common open solutions

- ***Reference architecture and design principles***
- ***Standards***
- ***Scale***

DIN 91357 standard

Formalise the capture of the core content as international standards

- **By 2025, ensure that 300m residents of EU cities are supported by Urban Platform(s) to manage their business with a city and that the city in turn drives efficiencies, insight and local innovation through the platform(s)**

Interoperability and standardization

The SAREF ontology

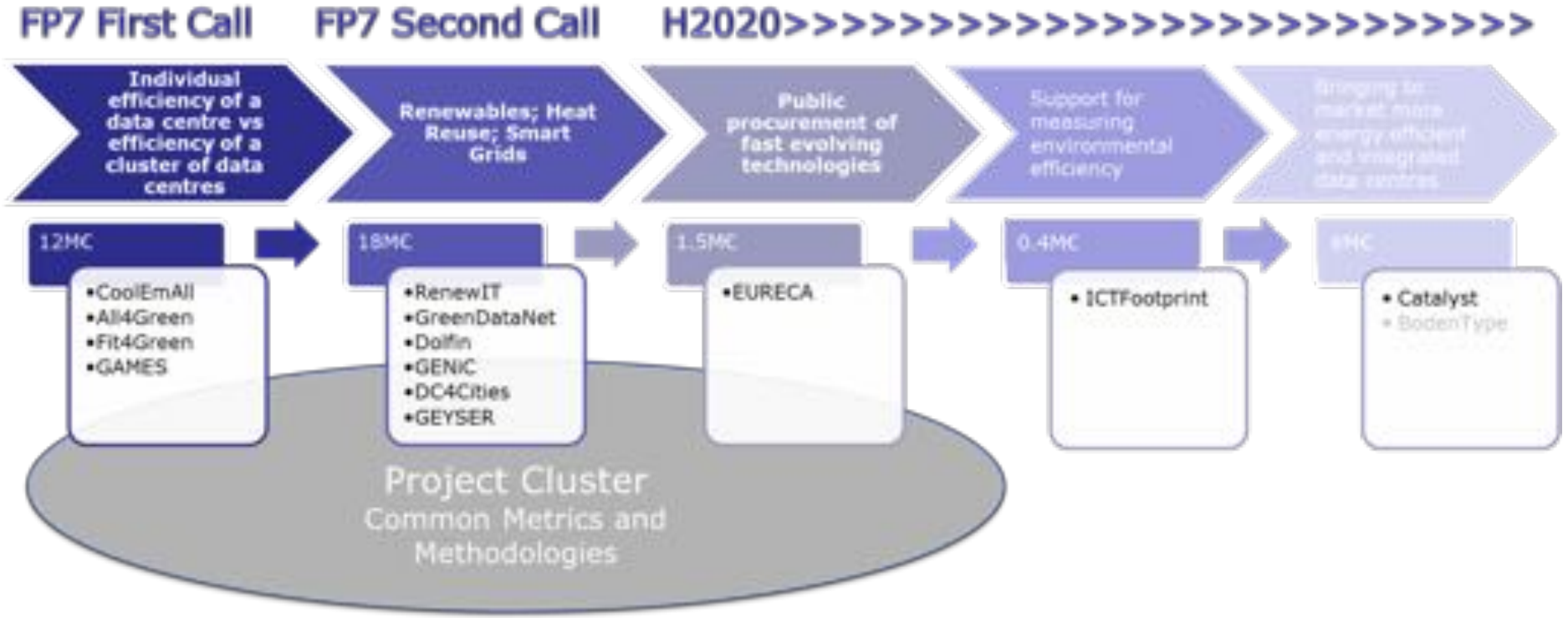
- SAREF (Smart Appliances REFerence ontology), the creation of which was fostered by the European Commission, is an ETSI SmartM2M/OneM2M standard since 2015

- Commercial products based on it since 2016

- Since January 2017 a new modular version of SAREF with ever expanding number of extensions - from Energy, Buildings and Environment towards Smart Cities, Smart AgriFood, Smart Industry & Manufacturing, Automotive, Health/Ageing-well, Water, Wearables…

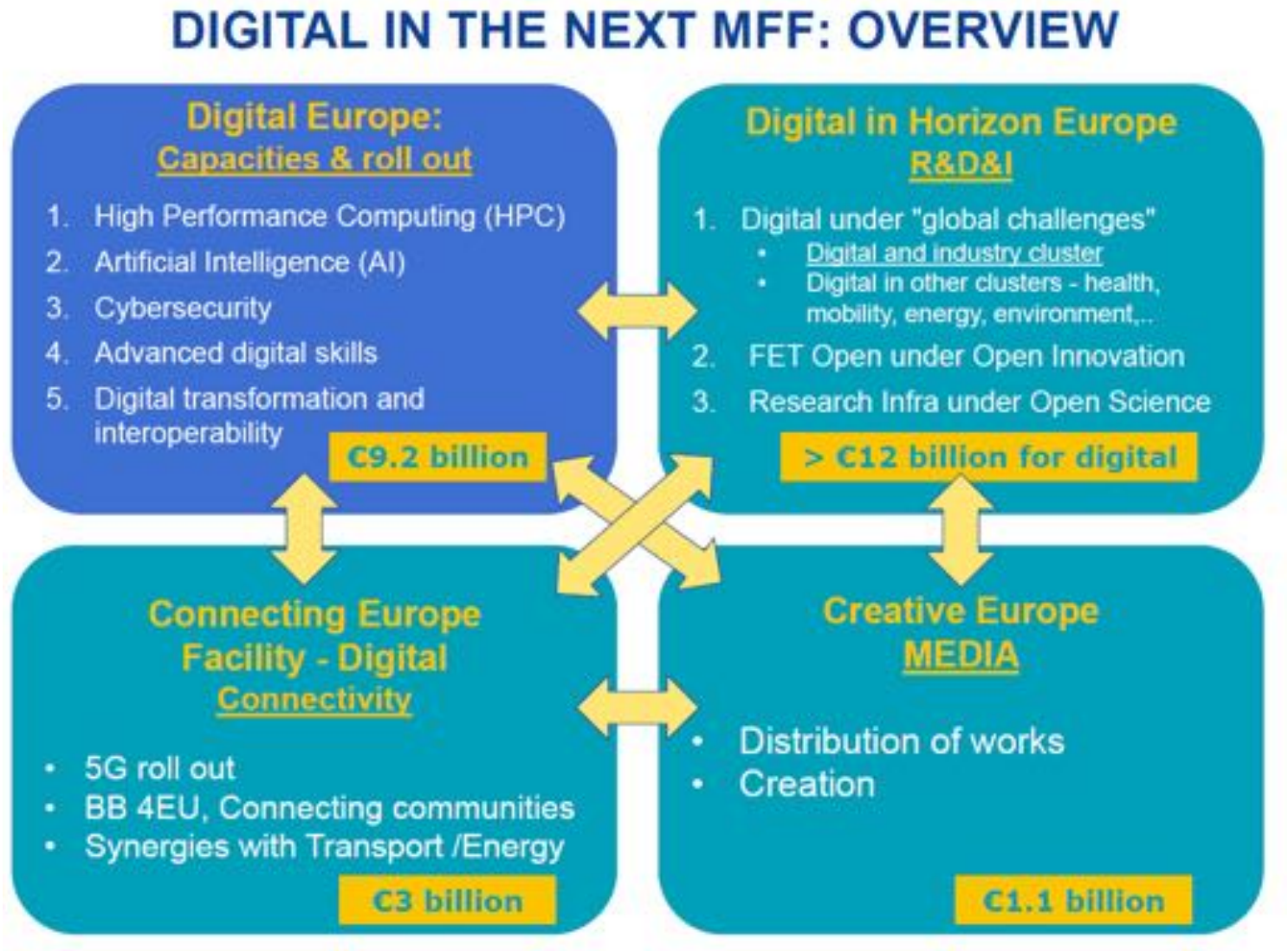
European Commission

EU FP7/H2020 initiatives on sustainable data centers



Digital in MFF 2021-2027

European Commission



Panel Discussion

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Additional Material

Process


Ecodesign Working Plan
Preparatory study
Consultation Forum on draft measures/ proposed voluntary agreement
Impact assessment on draft measures/ proposed voluntary agreement
Inter-Service Consultation
Notification to World Trade Organisation
24 months
3 months
3 months
3 months
2 months
WE ARE HERE!
Ecodesign (implementing acts) procedure
Regulatory Committee (discussion and vote)
Scrutiny by European Parliament & Council
Adoption by European Commission
Publication in the Official Journal
2 months
3 months
1 month
1 month

Is idle power consumption of servers relevant in the EU?

A data center taxonomy for the EU market – current figures and expected trends

Data centre type	2015	2020	2030
SME data centres	20%	15%	13%
Mid-tier/older data centres	18%	15%	12%
Colocation data centres	34%	40%	40%
Hyperscale/ Cloud data centres	28%	30%	35%

- When servers are running idle (i.e., doing no useful work), they still consume energy! (typically 25%-65% of the maximum power)
- Our understanding of the EU market shows that still nowadays, a not negligible portion of the servers on the market is operated at idle power for several hours per day
- Servers running at high utilization levels most of the time are already excluded from the idle power requirements (HPC servers, servers with integrated APA and resilient servers)

Findings from the EU H2020 EURECA Project (close to finalisation)

- over 350 data centres of public administrations in the EU were analised (ministries, universities, etc)

Fig. 4.3. Average Annual *Server Utilisation range*

And elsewhere?

- **Shehabi, A., et al, "United States Data Center Energy Usage Report." Lawrence Berkley National Laboratory. (2016).**

Table 1. Average Active Volume Server Utilization Assumptions

Space Type	2000-2010	2020
Internal	10%	15%
Service Provider	20%	25%
Hyperscale	45%	50%

And what will happen in the short-medium term?

- Reliable forecasts are very difficult
- Future upcoming trends: virtualisation, but also others who could go in the opposite direction, such as 'fog computing' and 'edge computing'.
- Consumer choice (perceived security for in house operations) and external constraints (infrastructures) could further delay the trend towards virtualisation

Main instruments

Ecodesign Directive 2009/125/EC: "Framework" defining the "rules" for setting product-specific requirements/legislation on energy efficiency and further parameters. Compliant products receive "CE Mark"

Compulsory

Energy Labelling Directive 2010/30/EU: "Framework" defining the "rules" for setting product-specific requirements/legislation on standard information of the consumption of energy and other resources

Other related instruments

Voluntary

Ecolabel: The EU Ecolabel helps identify products and services that have a reduced impact on the environment throughout their life cycle, from the extraction of raw materials through production, use and disposal.

Green Public Procurement: Voluntary instrument. GPP can help stimulate a critical mass of demand for more sustainable goods and services which otherwise would be difficult to get onto the market.


European
Commission

What is the problem

- European data centres consuming more than **104TWh (2015)** per annum representing **3%** of total electricity (PEDCA project)
- This could grow with **20%** by 2020 (**35% over 9 years** (Smart 2012/0064)) – compared to **falling or flat** rest of ICT
- Even worse for networks – growth in consumption **150% in 9 years** (Smart 2012/0064) – compared to **falling or flat** rest of ICT
- Some new trends such as **IoT, edge computing, SDN/NFV, etc. not taken** into account in above growth figures
- The **percentage** (and if no action the total consumption) **will only go up** as the other sectors become more efficient with ICT (**smartening**)
- Some member countries/cities are hitting the **limit of their power grids**
- There is an **ongoing improvement**, but pace is **slow** with potential to **get slower**

The EIP-SCC

European Innovation Partnership for Smart Cities & Communities

- ❑ 4,600 partners
- ❑ 370 commitments
- ❑ 31 countries

Deliver: scale, acceleration, & impact,...

Through: common solutions, an integrated approach, & collaboration

Focus on Energy, Transport and ICT

H2020

- **Lighthouse projects (~100 M€/year; ~4 projects/year; per project – 3 lead cities, 3 follower cities and other cities)**
- **CSAs (Espresso, CityKeys, etc.)**