



# Power Consumption in FTTH vs HFC-networks

An overview of the energy impact from the perspective of Green IT objectives



## Comparing power consumption impact requires an integral view

- **Why broadband power consumption became a policy issue**
- **Power consumption differences between FTTH and HFC**
  - on the operator side
  - for CPE, the hidden (social) cost
- **What happens to power consumption if bandwidth demand and traffic grows?**
  - node splitting, CCAP & Switched Digital Video
- **Conclusions**



## To counter rising broadband power demand EU launched Code of Conduct in 2007

- EU 2015 total broadband power may rise to 50 TWh
- Implementing Code of Conduct may limit it to 25 TWh  
A saving equal to 5.5 mln ton oil equivalent  
About € 7.5 bln per annum
- **Code of Conduct on Energy Consumption of Broadband Equipment**
- Current edition v 4.1 (January 2013)
- [http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/code\\_of\\_conduct\\_broadband\\_equipment\\_v4\\_1\\_final.pdf](http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/code_of_conduct_broadband_equipment_v4_1_final.pdf)



## A first surprising observation



- Manufacturers and Telcos participate, but CATV MSOs?

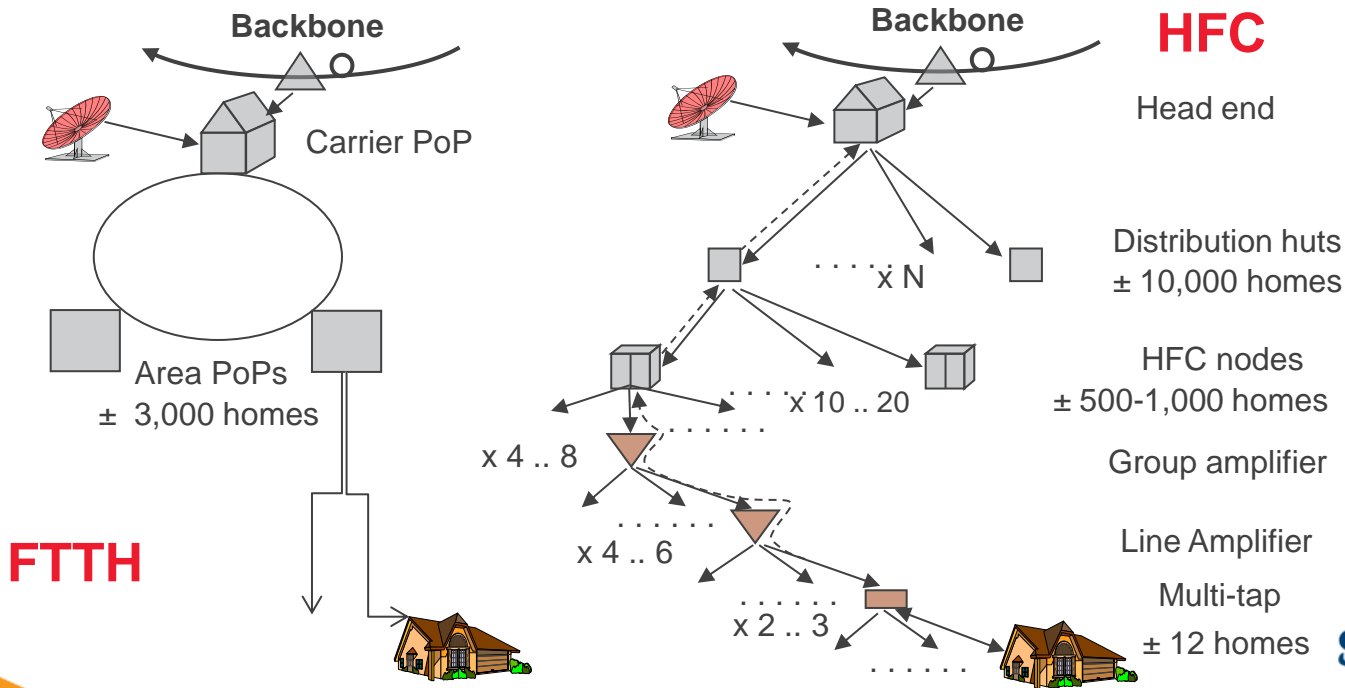


## Code of Conduct sets power usage objectives

- Urge, not enforce
- Tables with reasonable targets for interfaces and processing functions
- CPE target is approached combinatorial:  
DOCSIS3.0 WiFi-router target = sum of DOCSIS3.0 WAN interface, local Ethernet, WiFi etc.
- Power usage targets for idle, low load, full load



# Power consumption in an FTTH-net isn't that different from HFC-net



**FTTH**

**HFC**

Head end

Distribution huts  
 $\pm 10,000$  homes

HFC nodes  
 $\pm 500-1,000$  homes

Group amplifier

Line Amplifier

Multi-tap  
 $\pm 12$  homes

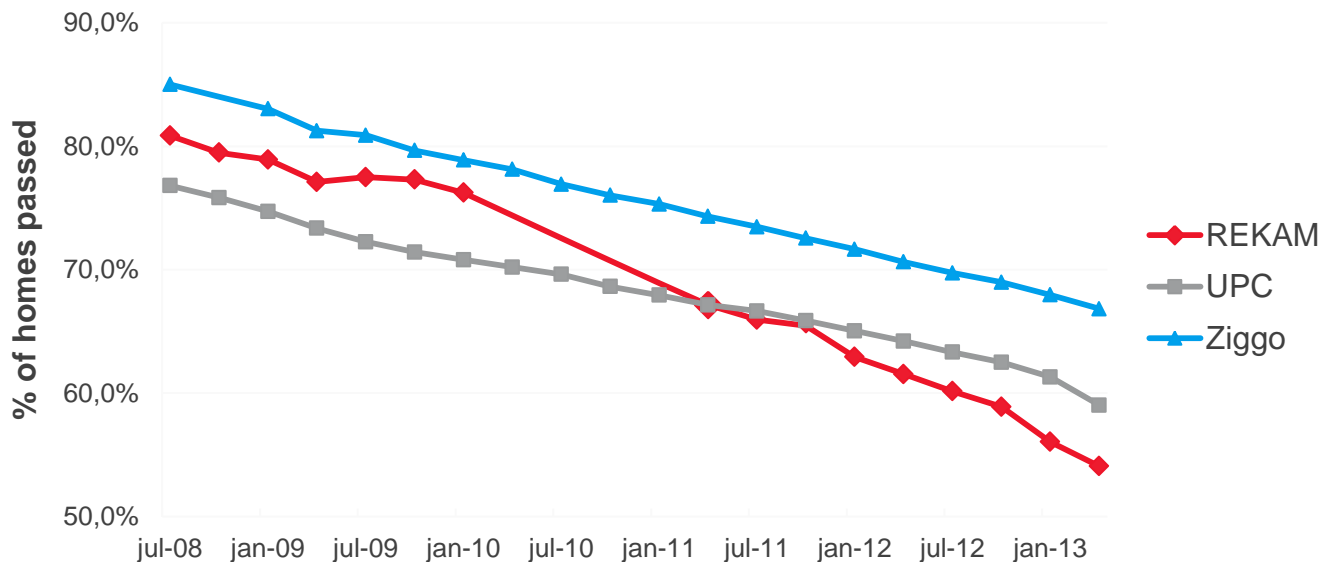
**Stratix**

**ibc.org**



With declining service subscriber numbers  
the power usage per subscriber rises

**Subscriber penetrations for 3 Dutch MSOs**





## Typical power consumption figures @ 60% subs penetration

	HFC Node	FTTH PtP	FTTH (X)GPON 2.5G / 10G
Annual (kWh)	15,000	30,100	4,100/7,550
Power (W)	1,700	3,438	468/862
# users	420	1,800	1,800
per user (W)	4.1	1.9	0.26/0.48





## Head-end and Carrier-PoP differ too @ 50k home city with 30k subs

	Head-End	FTTH Switch based	FTTH Router-based
Annual (kWh)	700,000	87,600	131,400
Power (W)	79,900	10,000	15,000
# users	30,000	30,000	30,000
per user (W)	2.66	0.30	0.50



## What is the origin of these differences?

- Complex modulation for cable is power intensive
- (Software based) Routing in CMTS is a power hog
- The power requirements for analog distribution services
- Low attenuation of optical signals allow easier decoding
- Not so new: big, power hungry core routers were an issue in Research Grid Computing networks in 2003/2004
  - development of hybrid optical/IP & Software Defined Networking



# More bad news for HFC: CPE-power usage

## Energy consumption impact per user & total

	DOCSIS3.0 8x4 + GbE		PtP ONU GbE + GbE		(X)GPON ONU 2.5G/10G + GbE	
	Idle	On	Idle	On	Idle	On
per user (W)	8.6	10.5	3.2	3.2	2.5 / 3.8	4 / 6
# users	30,000					
all users (kW)	258	315	96	96	75/114	120/180



FTTH uses 10-12W less than HFC in a network with 60% sub penetration

Per user (W)	HFC 8x4 + GbE		FTTH PtP GbE + GbE		FTTH (X)GPON 2.5G / 10G + GbE	
	Idle	On	Idle	On	Idle	On
CPE	8.6	10.5	3.2	3.2	2.5 / 3.8	4 / 6
Outside plant	4.1		1.9		0.26 / 0.48	
Head end/PoP	2.66		0.5		0.5 / 0.5	
Total	15.36	17.26	5.6	5.6	3.26/4.78	4.76/6.98



## The hidden (social) cost and the competitive operator cost

- 5 – 7 W from the difference per user between HFC and FTTH is due to the power needs of DOCSIS3.0 CPE
- @ current energy prices in Netherlands:  
consumers: 23 cts per kWh incl. VAT & taxes  
operators: 8 cts per kWh incl. taxes
- HFC adds €10-14 /yr to consumer energy bill
- HFC-net bill: €141k for 50k homes passed, 30k subs
- FTTH-PtP bill: €51k for 50k homes passed, 30k subs
- FTTH-GPON: €16k for 50k homes passed, 30k subs



# What happens to power consumption if traffic and bandwidth demand grows?

- In HFC networks the foreseen strategies are:

Node splitting:	Doubles CMTS power demand
CCAP:	Only partial solution (still that router)
Higher channel bonding:	Power consumption ↑
SDV:	Router load ↓ but (U)EQAM-ports ↑



## Conclusions

- Deploying FTTH reduces a cable operator's power consumption costs
- FTTH power consumption scales linear with subscribers
- When penetration declines in direct competition, the burden of powering costs starts to bite for HFC operators
- EU Green IT program Code of Conduct lacks MSOs as participant, might this be a reason for limited progress?
- As a relief: HFC compares well vs VDSL2/Vectoring