The Power of Residential Connectivity

Presentation by Gregg Hardy

Objectives of this presentation

- To provide an update on efforts to reduce U.S. set-top box energy consumption
- To understand set-top boxes in the context of total pay-TV and broadband service provider power use and emissions

Executive summary

- Customer premise equipment (CPE) uses the vast majority of total system power in providing broadband and television content to consumers
- Studies suggest that there are opportunities for breakthrough improvements in service provider and CPE energy efficiency
- National STB energy consumption is trending down
- Fundamentally, STBs remain powered-on 24 x 7
- STBs are being replaced by internet TVs, smart phones, tablets, laptops, and other IP devices
- Policymakers are making some progress on CPE energy consumption

Background

SET-TOP BOX PRODUCT CLASSES

PAY TV

Cable

Satellite

IPTV

STAND ALONE

Over the top (OTT)

Retail DVR (TiVo etc.)

Over the air (OTA) converter

SET-TOP BOX PRODUCT CLASSES – SATELLITE SPECIFIC HARDWARE

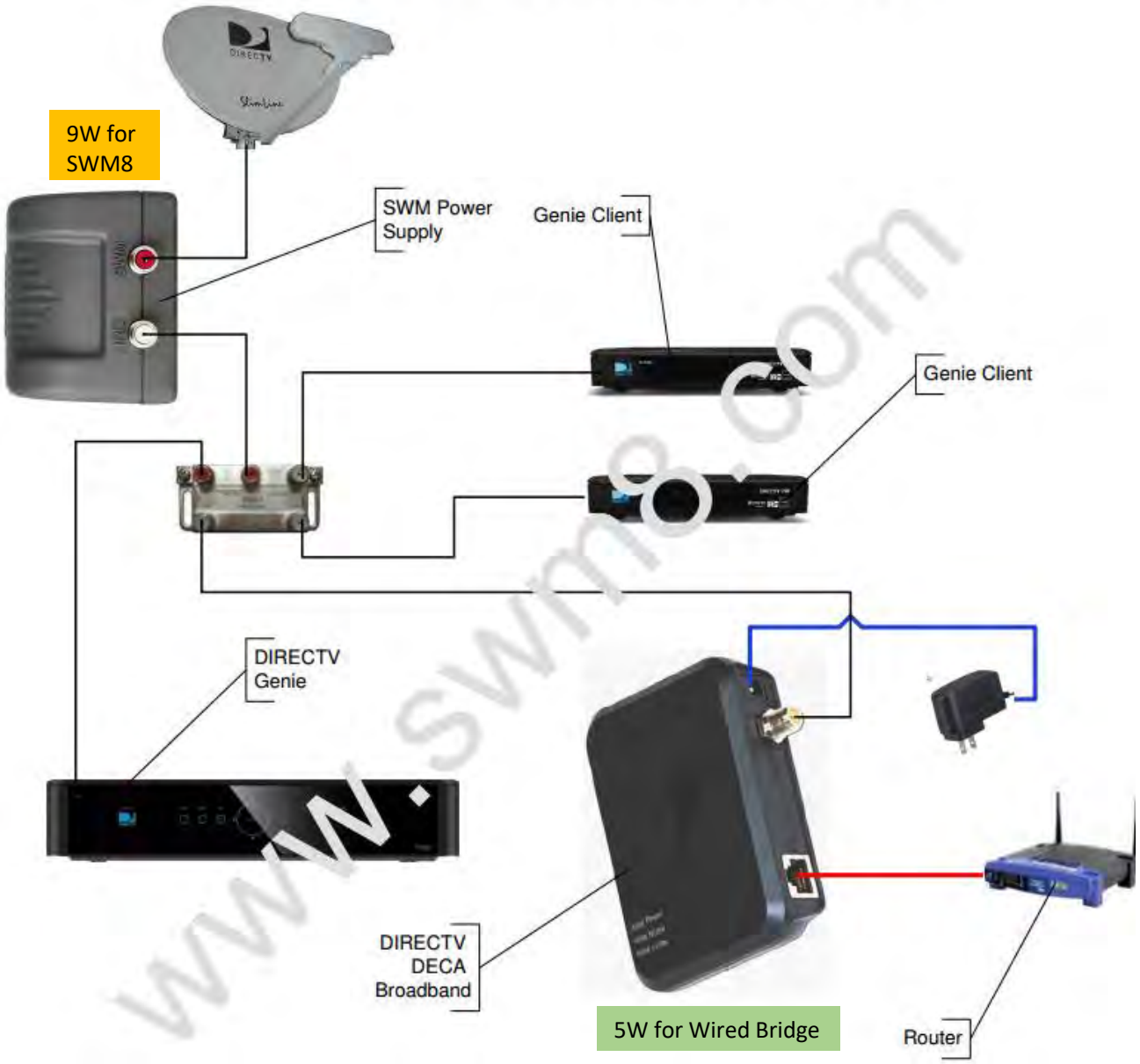
OUTDOOR UNIT (ODU)

Satellite dish and electronics

SWITCH

Splits signal and sends to multiple STBs

Wiring a DIRECTV GENIE and Two Clients to a Slimline SWM (single-output) Dish WITH DECA Broadband Connection



OTHER CUSTOMER PREMISE EQUIPMENT PRODUCT CLASSES

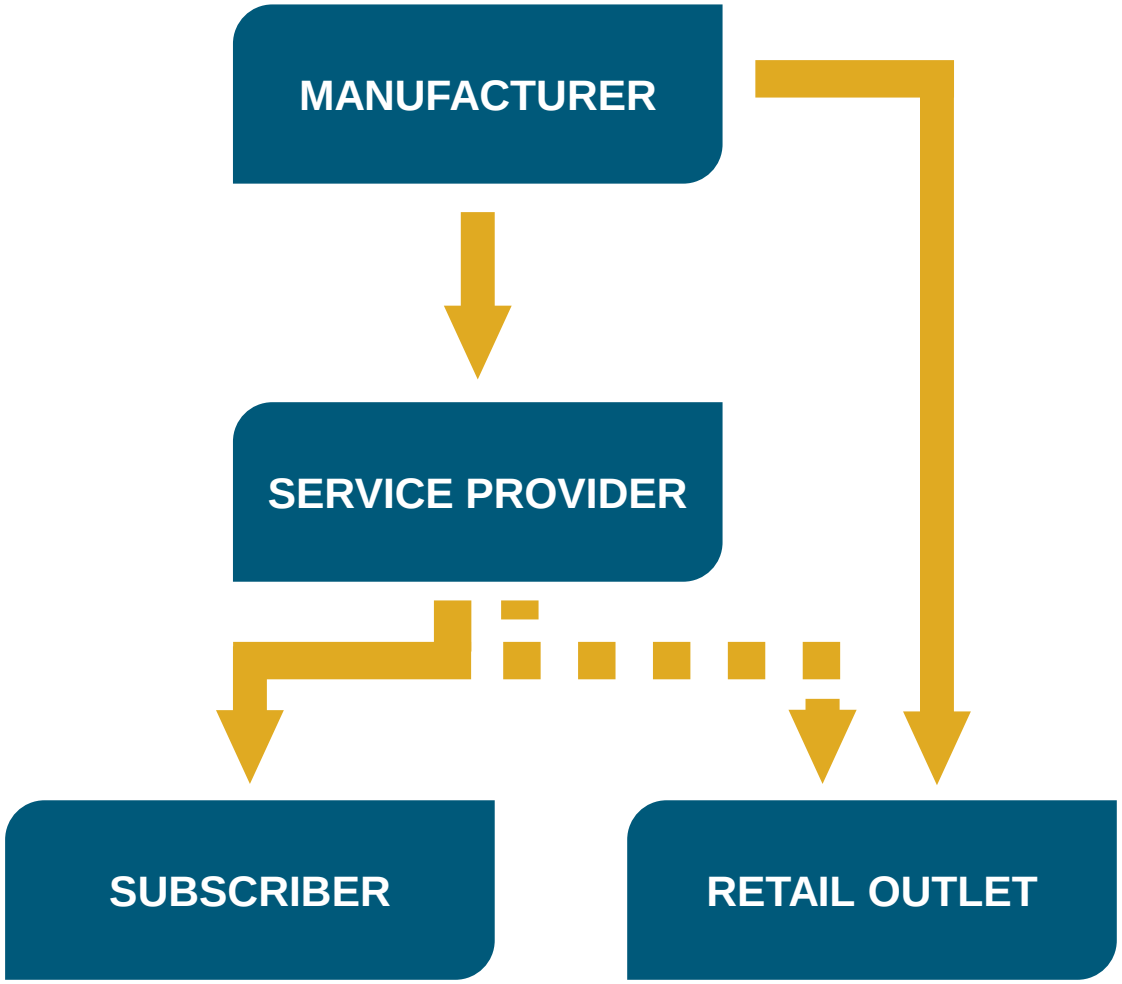
SMALL NETWORK EQUIPMENT

Broadband access

Local area network

Gateway

STB DISTRIBUTION MODEL



*Service providers choose, qualify, and configure STB models

STB savings opportunities & system configurations

SAVINGS OPPORTUNITIES – REDUCTION STRATEGIES

1. REDUCE ACTIVE MODE POWER DEMAND

- Consolidation and integration of electronics and chipsets
- Unused capabilities powered down (e.g. hard drive)

2. MINIMIZE SLEEP MODE POWER DEMAND

- Multiple sleep modes with varying degrees of functionality
- Deep sleep with scheduled wake-up for network communications

3. INCREASE THE EFFICIENCY OF HOUSEHOLDS WITH ACCESS TO RECORDED TV IN MULTIPLE ROOMS

- STBs with centralized DVR
- Thin clients with central gateway
- STB elimination through TV to gateway communication

Best in Class STB Swisscom IPTV

Based on Marvel SoC

Swisscom TV-Box IP1400 (04/2016 – today)

Power consumption

Operational mode	Power consumption in watts
Off	0.06 W
On (Live TV HD)	5.3 W
On (UHD VoD)	6.2 W
Active Standby	3.7 W

30 sec wake

Recommendations

If used daily

Because the Swisscom TV-Box is fully operational in just 30 seconds, you can turn it off completely overnight or during the day or disconnect it from the power source.

Longer periods of non-use

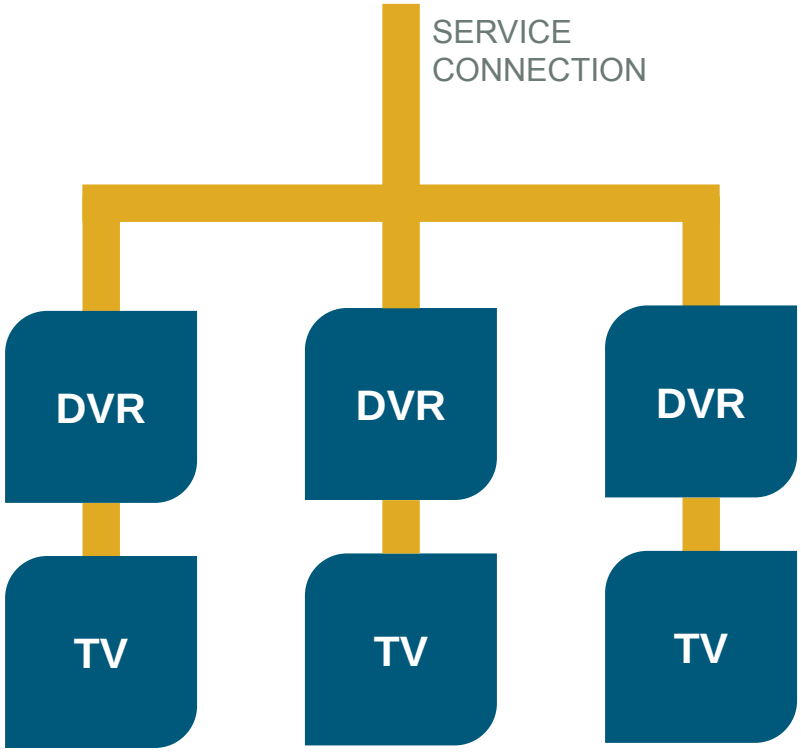
If you are not planning to use your device for several days or even weeks, e.g. during your holidays, we recommend you unplug it from the mains. This will reduce your energy consumption to zero. You can continue to use all the recording functions and still enjoy Swisscom TV 2.0 on your smartphone or tablet. When you start up again, wait until the modem is connected to the Internet before reactivating the TV-Box.

Note: System energy consumption impact of cloud DVR is unknown
Source: https://www.swisscom.ch/en/residential/services/save-energy/tv-box-ip1400.html

SAVINGS OPPORTUNITIES – STB REDUCTION STRATEGY

MULTI-DVR

The cable or satellite service connection is split and sent to multiple DVRs for live and recorded content viewing.



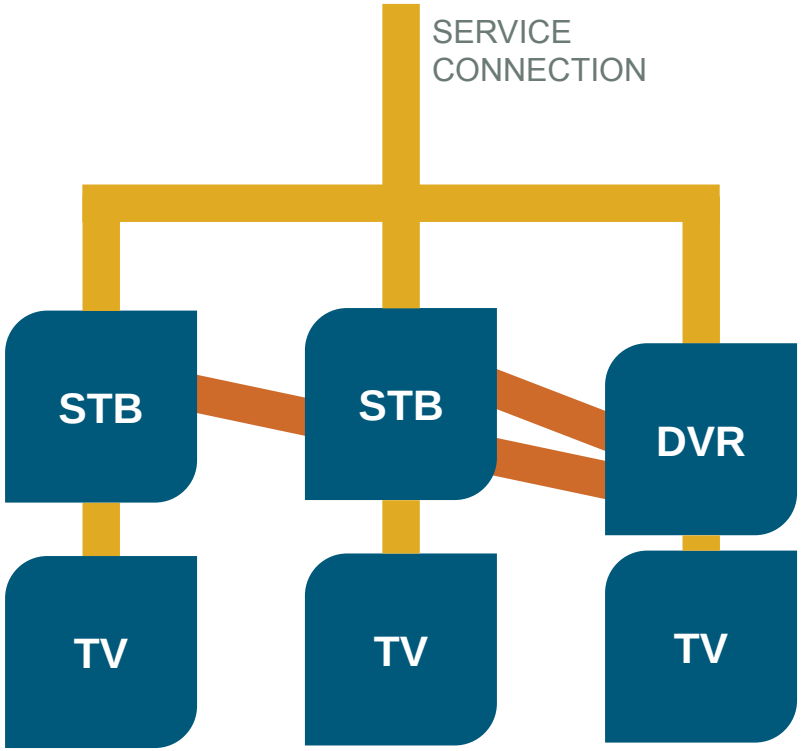
ANNUAL ENERGY USE	SAVINGS OVER BASELINE
660 kWh	-

Set-top Box (STB):	Set-top box without video recording capability
Personal Video Recorder (DVR):	Set-top box with video recording capability
Thin Client:	Slim line et-top box without video recording or headend equipment communication capability
Gateway:	Central device with video recording capability and headend communication equipment

SAVINGS OPPORTUNITIES – STB REDUCTION STRATEGY

WHOLE-HOME

The service connection is split and sent to multiple STBs and a single DVR. STBs handle live content internally while streaming recorded content from the DVR.

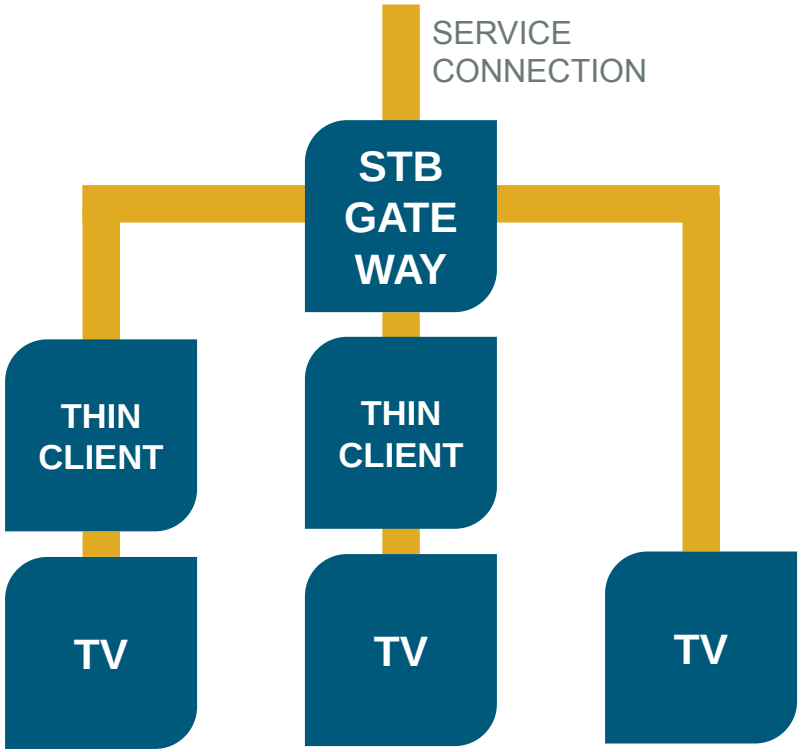


ANNUAL ENERGY USE	SAVINGS OVER BASELINE
530 kWh	130 kWh

SAVINGS OPPORTUNITIES – STB REDUCTION STRATEGY

MULTI-ROOM GATEWAY

The gateway device serves as a DVR and connection to the headend equipment, allowing STBs to be replaced by thin clients with deep sleep capabilities.

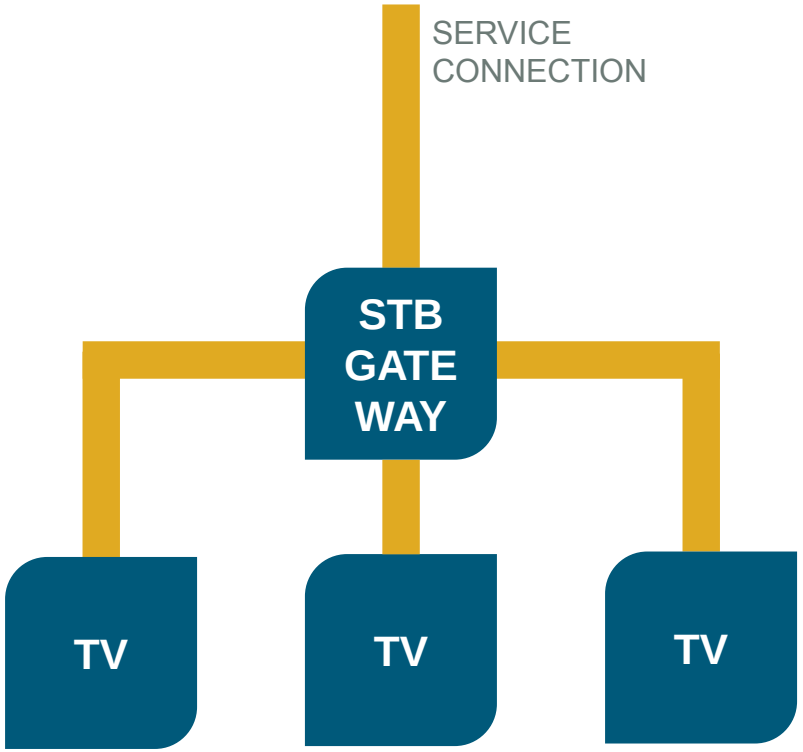


ANNUAL ENERGY USE	SAVINGS OVER BASELINE
410 kWh	250 kWh

SAVINGS OPPORTUNITIES – STB REDUCTION STRATEGY

EMERGING TECHNOLOGY – TV AS CLIENT

The gateway device again serves as a DVR and connection to the headend equipment. STBs are eliminated through technology embedded in the TVs.



ANNUAL ENERGY USE	SAVINGS OVER BASELINE
270 kWh	390 kWh

Comcast offers a TV app

Xfinity On Demand

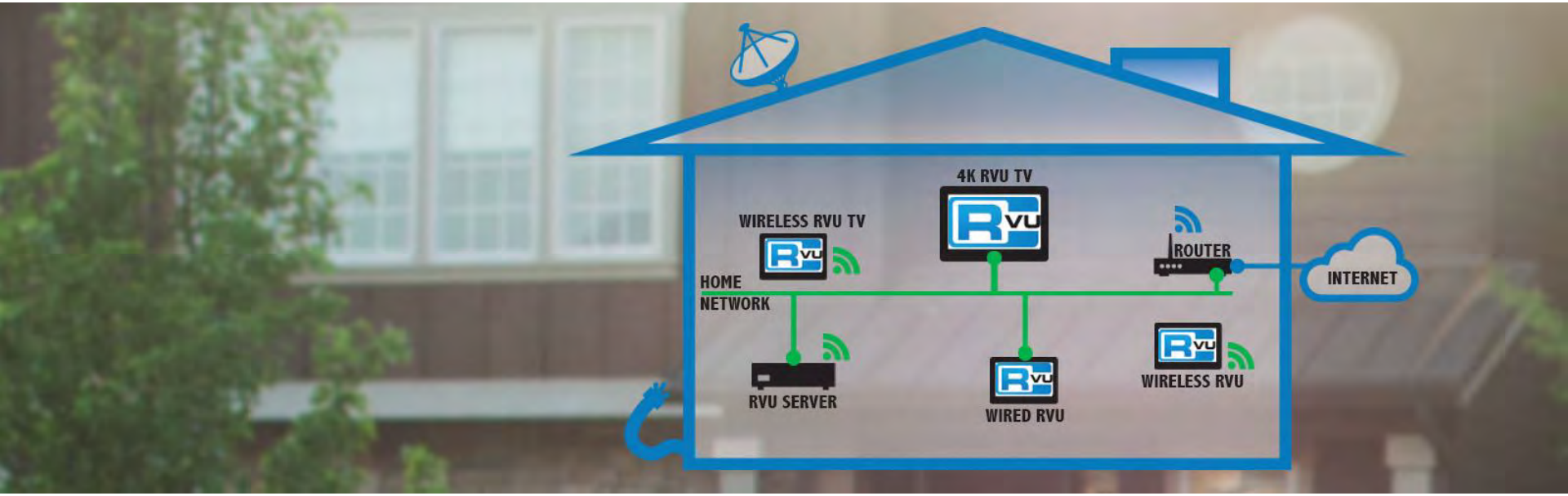
Enjoy instant access to thousands of hit movies and TV shows.

Xfinity TV Guide

View listings of upcoming movies and TV shows by airing date, time, network or channel number.

Apps are common in Europe

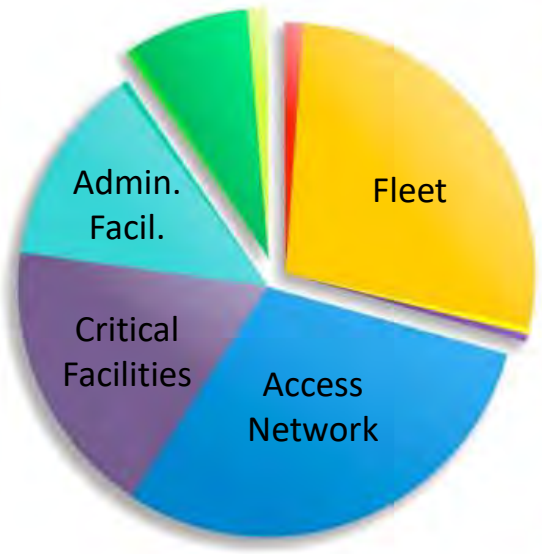
However, there are still barriers to apps-based approach to smart TVs



- Advantages
  - Smart TVs have faster processors than DirecTV clients
- Disadvantages
  - Wi-Fi quality of service (Qos) issues
  - Need for MoCA adapter if using Coax network
  - DirecTV client remote has more features than TV remote
  - DirecTV clients are kept up to date – smart TV electronics become obsolete

Emissions facts and trends

Typical cable MSO carbon footprint



Scope 1: 29%

- Generators & Heating Gas: 4%
- Fleet Vehicles: 94%
- Corporate Aircraft: <1%
- Fugitive Emissions (A/C): 1%

Scope 2: 61%

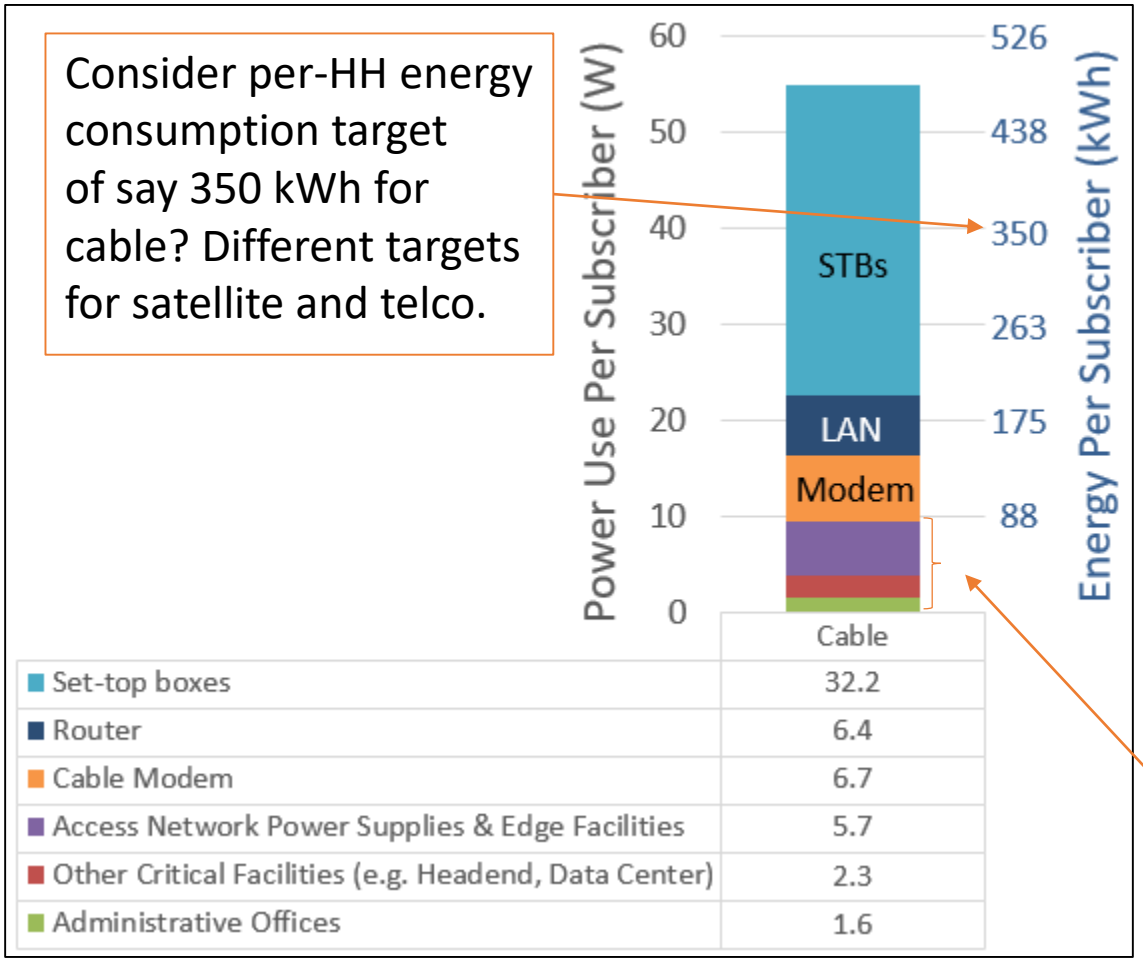
- Outside Plant Electricity: 49%
- Critical Facility Electricity: 29%
- Non-Critical Facility Electricity: 21%
- Purchased Steam: <1%

Scope 3: 10%

- Business Travel: 4%
- Employee Commuting: 84%
- Waste: 12%

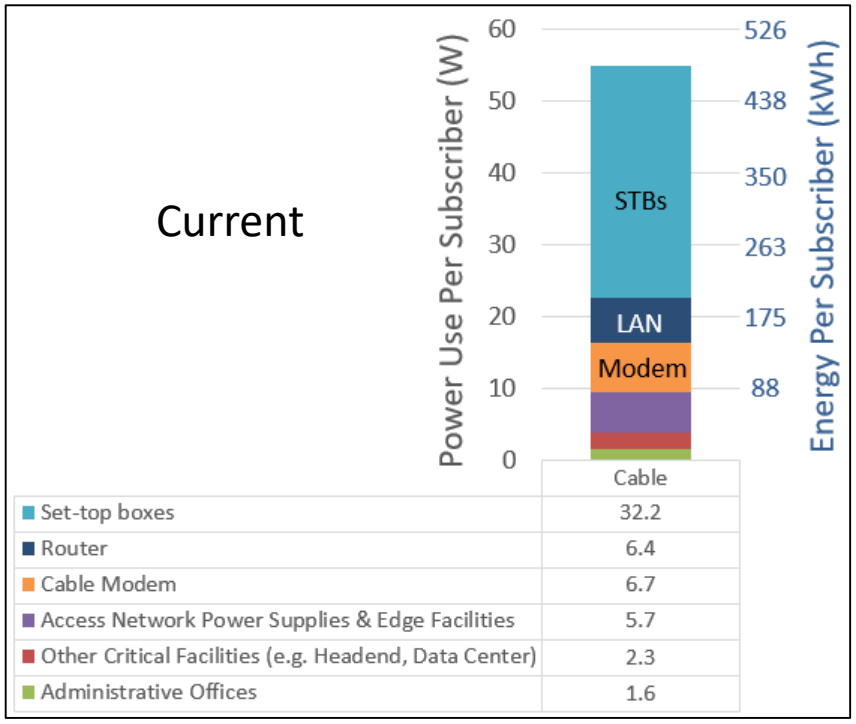
Source: Coppervale, Presentation at 2012 SCTE SEMI forum

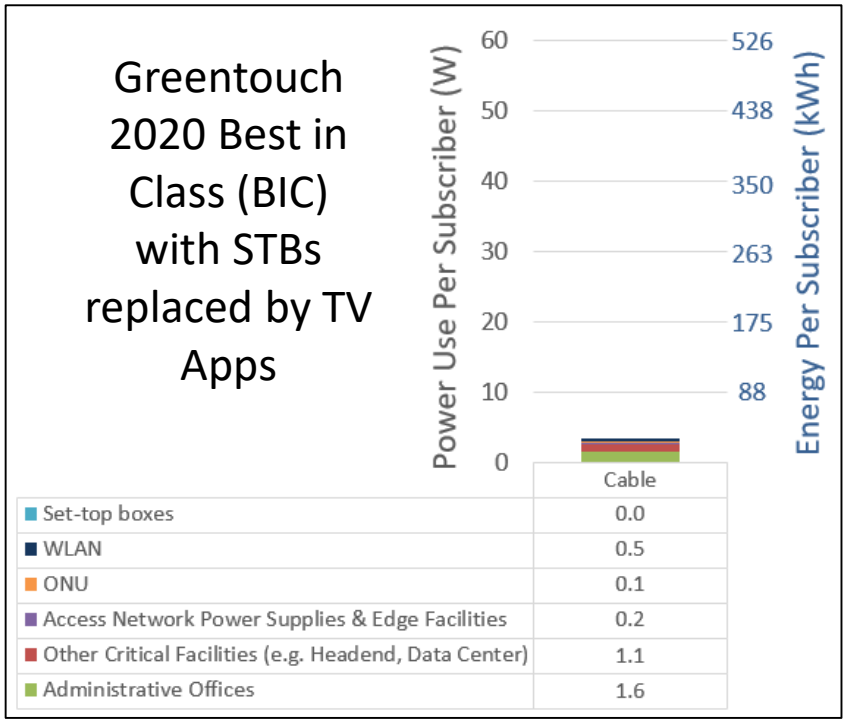
Average per household power use of cable service



Source: Coppervale 2015 White Paper, USVA 2016 SNE Report.

Greentouch consortium suggests that large savings per subscriber are possible

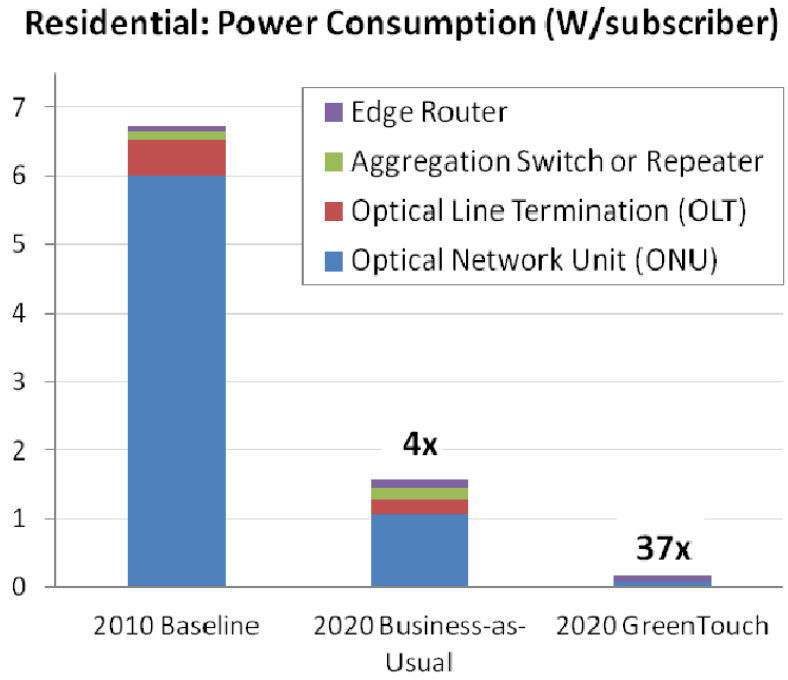




Source: PCL Analysis of Greentouch 2015 final report

Greentouch 2020 roadmap detail:

<1W for Access Network and ONT Gateway



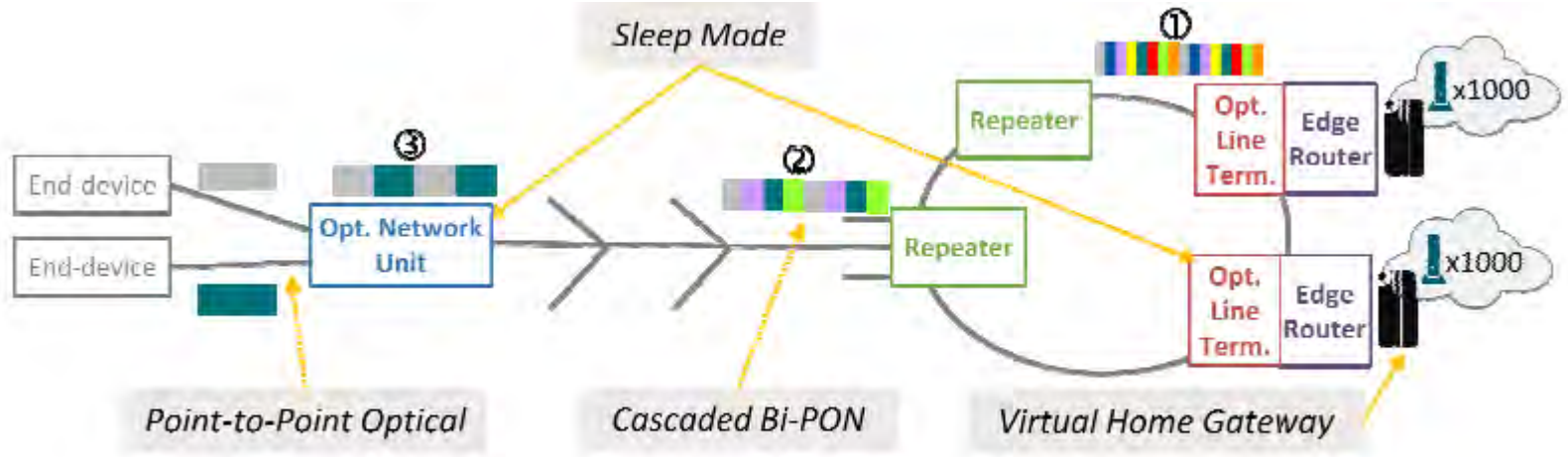
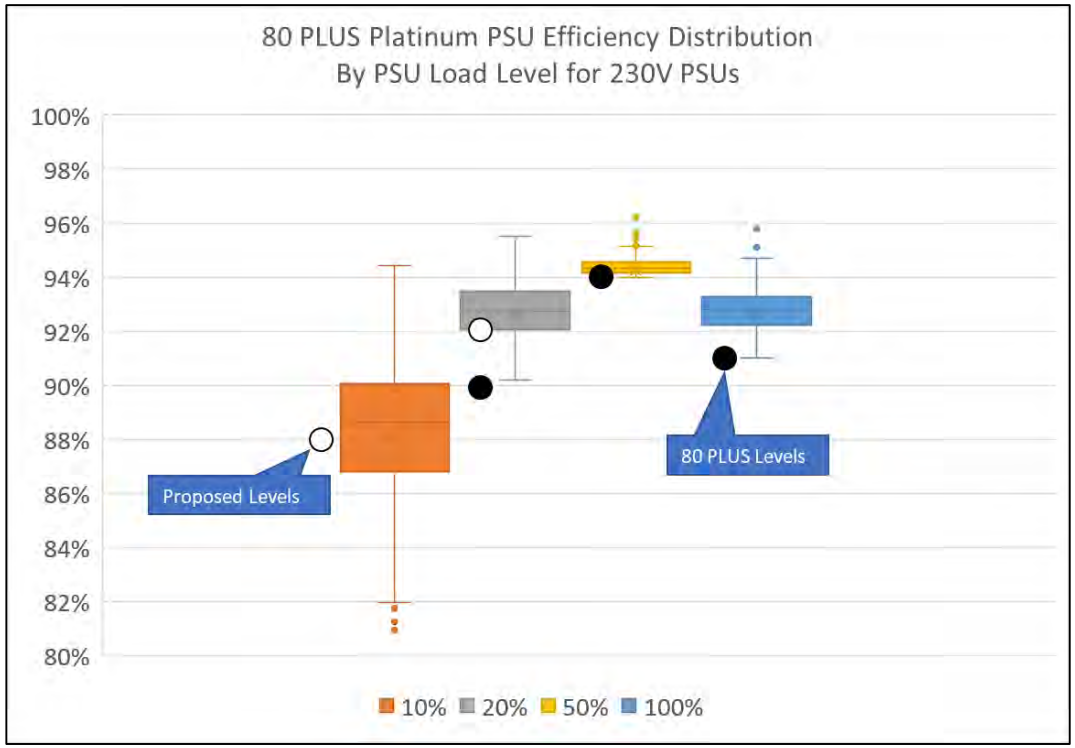
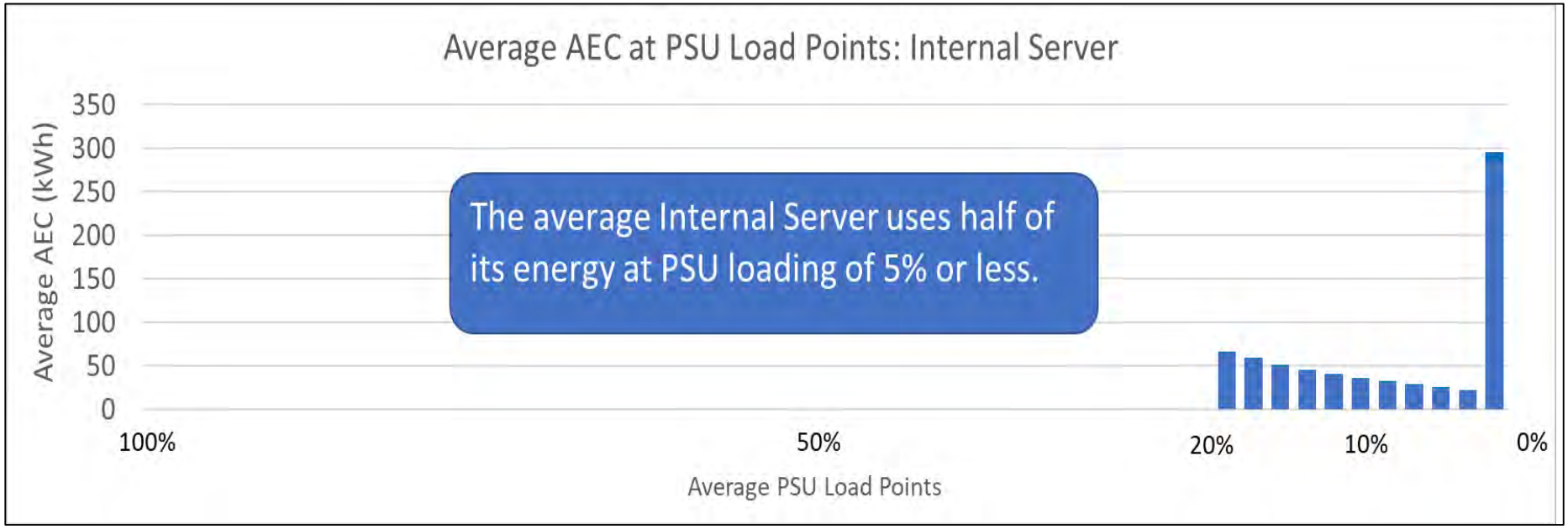


Figure 5: Network architecture of GreenTouch residential access network

Service providers could save energy by using power supplies that operate efficiently at low load points

Source: NRDC comments to EPA

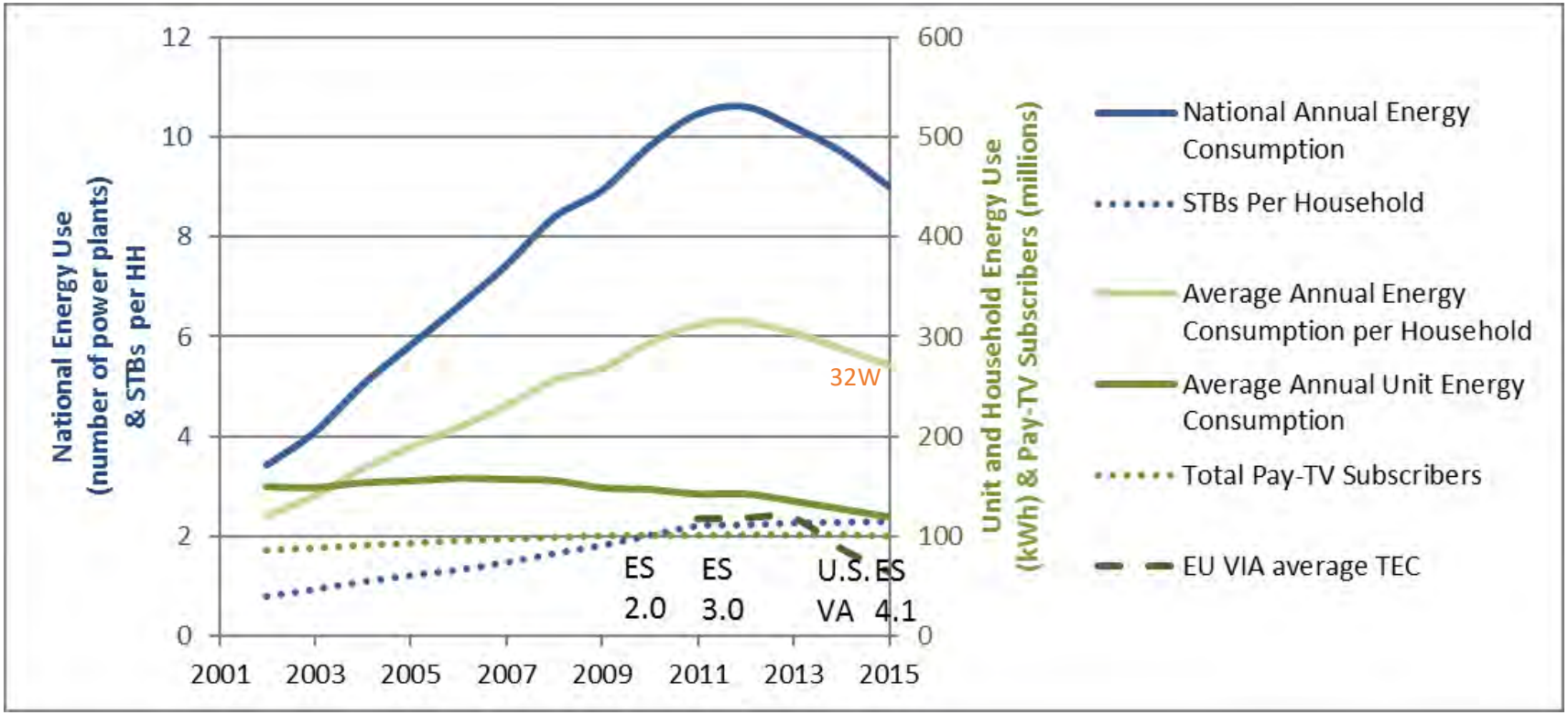




Caution: Shift to fixed wireless is coming – less efficient than wired

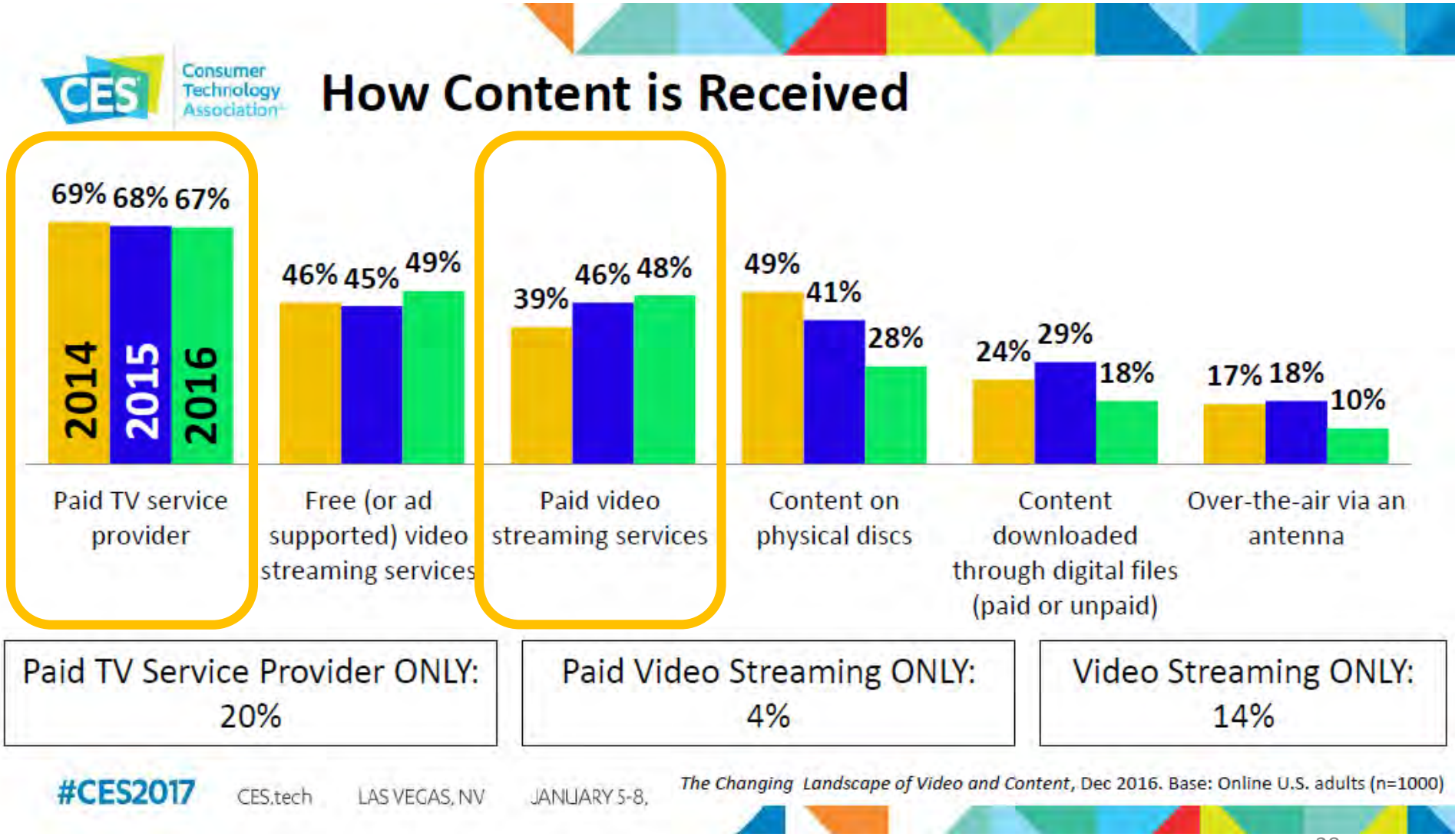
- ***Fixed wireless*** is shaping up to be a hot area in 2017, with companies as diverse as Verizon, AT&T, Google and smaller players getting serious about the technology. While the technology has been around for a long time, it's on track to get a major bandwidth boost when 5G spectrum becomes available. In the meantime, service providers are planning field trials and more for 2017. Some carriers also view fixed wireless as the best solution to meeting Connect America Fund (CAF) broadband deployment requirements and carriers will need to get moving soon on that front in order to meet FCC-mandated deployment targets. http://www.telecompetitor.com/seven-top-telecom-trends-for-2017/
- Google's announcement in October that it was pausing Google Fiber deployments crushed the super high-speed broadband dreams of many who hoped Google would come to their city next. But the decision to pull the plug is not the end of fiber or high-speed internet access. Google Fiber has helped spur rivals like Comcast and AT&T to increase speeds on their broadband service. And AT&T has been rapidly expanding its fiber network, which will continue into 2017. Fiber is still a key part of the wireless industry's ambitions to build 5G service. The big difference in 2017 and beyond is that Google, AT&T and others will be looking to **wireless** to provide high-speed broadband for that "last mile" directly into the home instead of fiber. https://www.cnet.com/news/seven-mobile-trends-to-look-for-in-2017/

STB energy trends



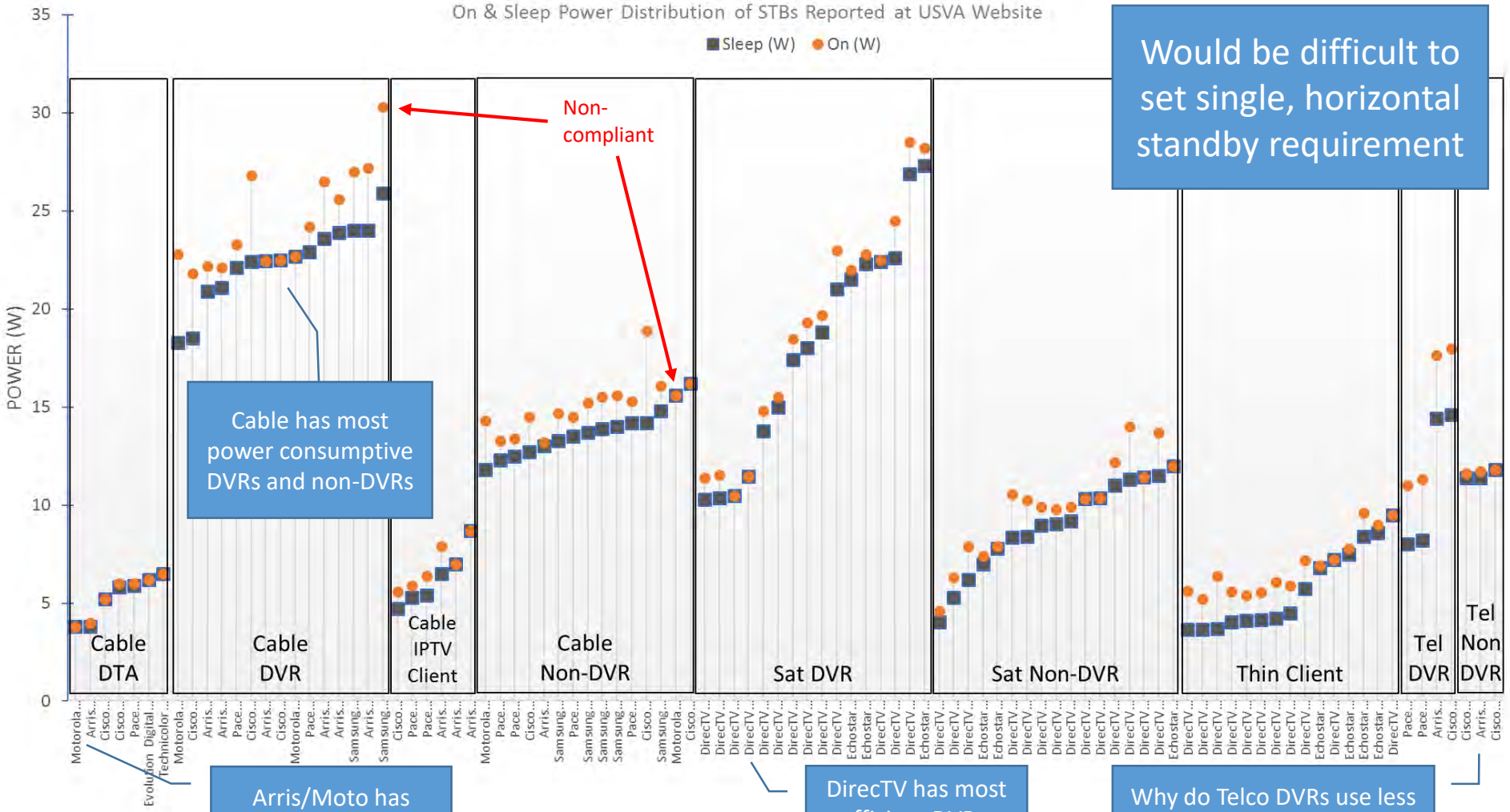
Sources: SNL Kagan (2012), NRDC (2011), Porter, Moorefield, & May-Ostendorp (2006), Urban, Tiefenbeck, & Roth (2011), Urban & Roth (2014), USVA Reports (2014, 2015, 2016)

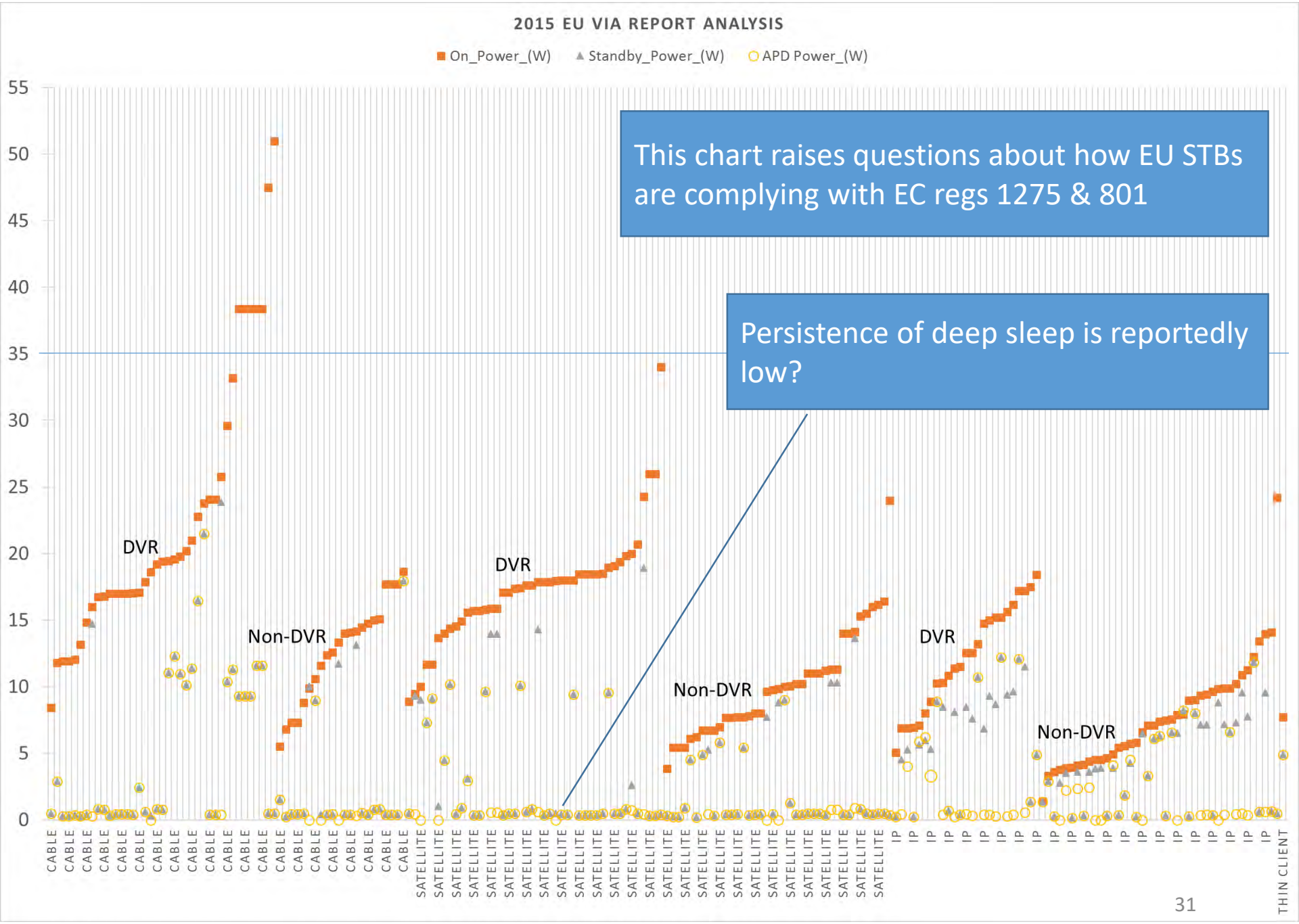
Growing adoption of OTT streaming



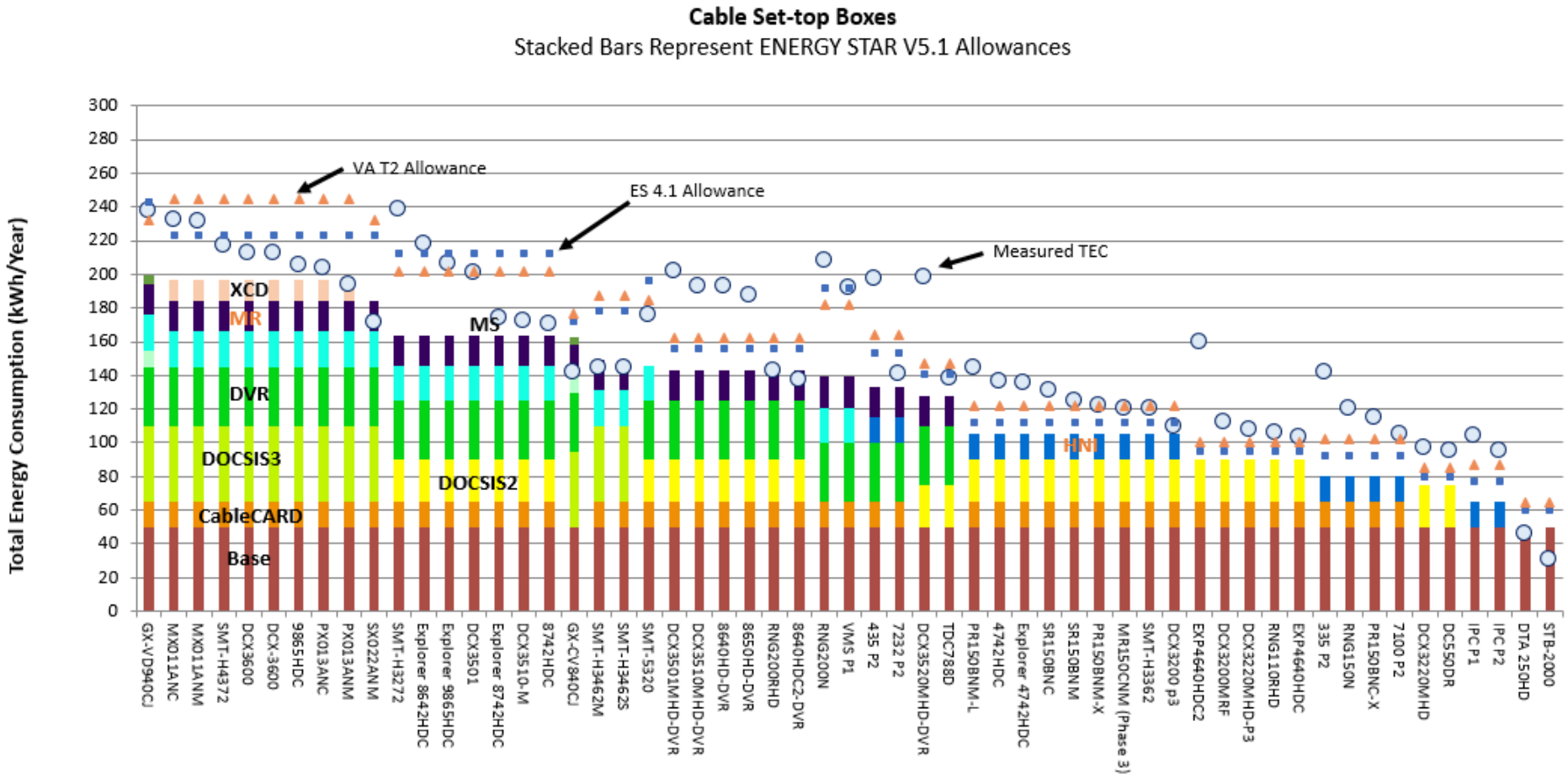
STB power and energy level analysis

U.S. STB power distribution by type & brand




2015 EU VIA REPORT ANALYSIS
On_Power_(W)
Standby_Power_(W)
APD Power_(W)
This chart raises questions about how EU STBs are complying with EC regs 1275 & 801
Persistence of deep sleep is reportedly low?
DVR
Non-DVR
DVR
Non-DVR
DVR
Non-DVR
55
50
45
40
35
30
25
20
15
10
5
0
CABLE
SATELLITE
IP
THIN CLIENT

VA Tier 2 levels compared to ES5.1



Thank You!

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