Can We Talk? Utilities to Cable, Satellite and IP Service Providers: Is Better Dialogue Needed to Achieve Energy Savings with Set-Top Boxes?

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ABSTRACT

Energy efficiency advocates have seen energy consumption from set-top boxes (STBs) grow significantly during the past decade. This growth is the result of an increasing number of STBs installed in homes and the advent of higher end services (e.g., high definition and DVR) combined with the need to support legacy systems. Version 2 of the ENERGY STAR® specification, which took effect in 2009, increased the availability of more energy-efficient STBs, resulting in per unit savings of up to 50% for most STB models. As a result, most manufacturers now produce ENERGY STAR-qualified products. Version 2 of the specification also offers partnership to service providers (of cable, satellite, and IP, also referred to as MVPDs) with a requirement that providers commit to purchasing and fleet requirement for STBs. These partnerships have not materialized as robustly as manufacturer partnerships, despite the availability of qualified STBs. For example, there are currently no major cable service providers partnering with the ENERGY STAR program. This paper identifies the main barriers to service provider participation and strategies to overcome them. More importantly, the availability of energy-efficient STBs only address a portion of the potential energy savings available through MVPDs. This paper is meant to help energy efficiency program administrators have more productive dialogues with service providers about energy saving opportunities in the home and throughout the MVPD network.

Background

STB Market Conditions

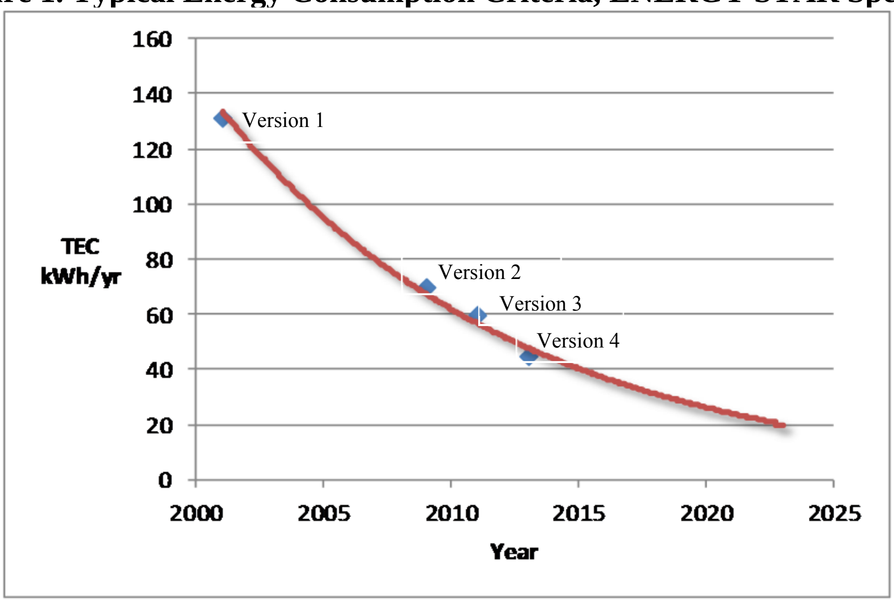
The television market gives consumers limited choices of hardware and service providers. Some consumers may choose a service after selecting the hardware a particular MVPD makes available; however, choices become infinitely more limited, or nonexistent, if the consumer first chooses a provider. After technology considerations (e.g., rural subscribers are limited to satellite), the primary drivers of these two choices are hardware features and programming options, neither of which is likely to be guided by energy efficiency. Subscribers would not likely choose a more energy-efficient service that has fewer features.

With proper design, the impact of a consumer’s experience can be minimized or eliminated. More energy conscious design approaches should eventually enable changes within the industry. The barrier has traditionally been the choice of hardware that serves the interests of the MVPDs and not necessarily the consumer. With more options available for consumers brought about by an over-the-top revolution and competition in the content delivery market, the critical market mechanism of consumer choice will drive further innovation in the market place.

A Brief History of the ENERGY STAR STB Specification

In 2005, the first ENERGY STAR specification for STBs was implemented, focusing on the standby power of STBs. After the specification was finalized, no original equipment manufacturer (OEM) partnered with ENERGY STAR. The only STBs on the market had relatively uniform capability as single TV STBs with standard definition video output capabilities. DVRs had a relatively small market, despite being introduced in 1999, and often, as with TiVo and ReplayTV (the two STBs with the largest market share), DVRs used a MVPD-provided STB for access to the content stream. Feedback was that MVPDs were asking OEMs to try to reach ENERGY STAR targets on their single standard definition boxes, but forgo labeling the box because the MVPD was not interested in paying the 1 cent label cost. ENERGY STAR then pulled back the specification (the first time this has happened) and regrouped to address the unique STB commercial market, assess the new features and technologies, and ensure that the specification provided enough incentive for OEMs and MVPDs to participate. Soon, the burgeoning market for high definition (HD) and DVR functionality came to the forefront.

Figure 1. Typical Energy Consumption Criteria, ENERGY STAR Specifications[1]



Source: U.S. EPA for ENERGY STAR minimum criteria (www.energystar.gov).

In 2007, development of the ENERGY STAR Version 2 specification began, during which four major departures from then typical ENERGY STAR specification processes occurred. The first was that not only OEMs, but also MVPD/MVPDs were offered an opportunity to partner due to their huge involvement in choosing and buying STBs, as well as the control they have over STB behavior. The second difference was choosing a typical energy consumption (TEC) approach as the main metric to create incentives for power management features. The third change was having a system in place for dealing with greater range of product design features under the umbrella of STB, such as HD, DVR, and digital transport adaptors. The

[1] The typical energy consumption (TEC) in ENERGY STAR Version 1 derived from 15-watt limit on standby power and assumed operation 24 hours per day, 365 days per year. The line in the figure was derived using an eight-year half-life for TEC: $TEC = TEC_{V1} * Exp^{(\ln(0.5)/8 * (Year - 2001))}$

fourth change was that for one or two revisions, the specification allowances were set as aspirational goals, and did not reflect the current best in class (partly because there was a limited power differential between various competing STB units).

In 2010, the 2007 version was refreshed, lowering the allowances and making some minor housekeeping changes. A new revision is in the development process this year to revise the 2010 version.

Approaches to Reducing STB Energy Use

Energy savings from STBs can be attained through two general approaches: (1) reducing the energy consumption of each STB installed in a home, and (2) reducing the number of STBs, especially the number of high energy-use STBs, in a home. Both of these approaches are reflected in the current ENERGY STAR specification, which rewards an array of savings opportunities and reflects the energy use of STBs as part of a consumer's MVPD experience.

Approach 1. Reduce the Per Unit STB Energy Consumption

From an energy efficiency standpoint, STB design was virtually unchanged from product inception to 2008. Engineers and product developers focused on customer experience and had minimal regard for energy efficiency. However, STB design changed as the potential for energy savings became more apparent, along with various new technologies such as System on a Chip, dropping analog, and the widespread availability of broadband. Three fundamental elements of energy-efficient design are listed below, and these ideals underlie the ENERGY STAR specification approach.

A. using power more efficiently during periods of activity
B. minimizing power consumption when the device is not active
C. enabling components and devices to drop into low-power modes as often and as deeply as possible

A. Using power more efficiently during periods of activity. The electronics industry is able to continuously increase the efficiency of STBs during periods of activity due to Moore's Law. Moore's Law is a natural progression embedded in semiconductor development in which the physical die size of semiconductors with equivalent capabilities (e.g., transistor count) is reduced by half every 18 months to two years.

The inverse corollary is also true. All thing being equal, as the die size decreases by half, the power consumption decreases (Koomey, Berard, Sanchez & Wong 2011), provided that control over leakage rates can be maintained as the transistor size decreases. This gives ASIC/IC chip designers choices based on any number of factors, but ultimately, if the amount of performance is held static, over time the chip will decrease in power consumption. Ultimately, the designers will likely choose to add more features and capability, but those features and capabilities will use proportionally less energy over time.

Smaller die sizes reduce the costs for STB manufacturers, because the number of chips per wafer (a.k.a. yield) increases. As a result, the power consumption for each new generation of STBs with equivalent feature sets has decreased. Additionally, when the United States transitioned from analog to digital TV signals, the STB industry was able to remove analog components from many devices, resulting in a significant power reduction without any engineering effort aimed specifically at energy savings. Also, OEMs balance energy efficiency and costs in their efforts to create less expensive products and faster-to-market designs.

B. Minimizing power consumption when not active. ENERGY STAR helps promote interest-balancing in a specific direction by rewarding all forms of total energy consumption (TEC) energy savings.[2] As a result, ENERGY STAR has created opportunities for energy savings, from scaling power consumption as the functionality of the device changes to rewarding most of the conceivable paths of energy savings. Designers are provided with choices for optimization based on their costs and product design goals.

C. Enabling components and devices to drop into low-power modes. ENERGY STAR's approach has also created savings opportunities for devices that drop into sleep mode more quickly and more often when not in use.

To take advantage of sleep functionality (and reduced energy use), STBs must be able to either disconnect from the network or partition network access away from the rest of its functionality. This concept of designing systems with the intent that STBs would be on 100% of the time was foreign to the industry. As a result of earlier designs, large amounts of data come embedded within the broadcast signal of cable and satellite systems. These embedded data includes authorizations and electronic program guide (EPG) updates, which are important features to consumers.

STB engineers can balance consumers' experiences with energy savings by collecting EPG and authorization data while having limited or no access to the video stream. This requires either a separate data channel and/or a two-way out-of-band data channel to transfer the data. As part of Version 4 STB revision proceedings, ENERGY STAR provided an incentive to the electronics industry to reach a 3-watt deep sleep. Energy savings incentives can also be derived from a sleep mode state that does not reach the definition of deep sleep, but is lower than the current readily achievable sleep levels. These non-deep-sleep levels range from almost deep sleep to active mode, and savings are currently derived in a variety of ways from turning off personal video recorder (PVR) functionality, to shutting down non-critical parts of the STB, to having the STB repeatedly drop into a deep sleep power state but wake from it multiple times per hour for brief update periods.

It is beneficial for the electronics industry to approach deep sleep in the following two stages in order to ensure consumers' experiences stay positive.

- The first stage is to stop reading the video stream for embedded data, but instead collect this data through a secondary network (such as cable's data over cable service interface specifications two-way path). STBs would not have to tune, read, and parse large amounts of video solely to find small bits of data. The video functionality can then be put into a low power state while the two-way network remains active.
- The second stage is to allow the two-way network connection to drop into a low power state (or to shut off completely) until the user activates the device or the device activates itself to receive data.

[2] TEC is the amount of energy consumed in a year based on calculating the power consumption in various modes multiplied by the hours in a year, then weighted based on the percentage of time spent in each mode.

Approach 2: Reduce the Number of STBs in a Home

As the number of STBs per home continues to increase—as a result of increased consumer demand for functionality and the digital transition that requires older TVs to have boxes—a more customized approach to STB energy efficiency could provide substantial energy savings. Technologies and configurations that provide versatile, customer-oriented experiences will thrive in the market and are likely to provide energy savings by requiring fewer STBs per home.

Another approach to reducing STB energy consumption focuses on the system of STBs in a home, with a goal of reducing redundant functionality. A multiroom approach can replace the comparatively high function/high power STBs (e.g., HD PVR) with a lower-function STB (e.g., HD non-PVR) while providing the same or better user experience. This is accomplished by enabling a home's multiple non-PVR STBs to access content stored on a single PVR, as opposed to operating multiple PVRs. Currently, multiroom options are available from some service providers in both the United States and Canada.

A further extension of this concept is the gateway, which replaces a stand-alone HD non-PVR device in the multiroom approach with "thin clients." These thin clients use less than half the energy of a stand-alone box[3] because they have no conditional access system, and therefore have no direct connection to the service network. When they implement a sleep state, they consume approximately 25% of the energy of a typical stand-alone. Thin clients rely completely on a gateway device for content (typically, the PVR device), which accesses content from the service provider on behalf of the consumer's device. Some service providers in the United States and Canada are currently piloting gateway offerings.

The last step in this particular evolution of broadcast content delivery replaces the need for an STB to be an interface between the gateway device and TVs in the home. Once the standards promulgated by an organization, such as the RVU Alliance, are incorporated into television technology, TVs will be able to draw content directly from the gateway device. One issue with this technology is that only TVs sold after incorporation of the standards will universally incorporate this type of feature, leaving a large stock of existing TVs without this technological option.

The intent of RVU Alliance and other similar organizations is to provide devices independent of the box that interact with the head end and the media device. RVU does not address intersystem compatibility, such as what Cable Card was designed to do, but instead addresses the issue of tying media to a head end connected device. As a result, RVU expands the amount and type of devices available to end users while allowing service providers to maintain control over the connection to the head end. RVU is like the Digital Living Network Alliance organization, with some modifications. AirPlay by Apple is similar to RVU in its purpose of device independence, but within the vertical market of Apple products.

Another potential source of market change, a commercial factor rather than a technological factor, is recent market activity that could potentially drive technological change. Various IT industry behemoths have purchased the two major STB OEMs in the North American market; the impacts of which will be felt for years. Expect an ever-increasing product tie-in between STBs and other internet connected devices, such as tablets and smart phones.

[3] As evidenced by the small allowance provided for in the ENERGY STAR specification.

Why Per-STB Energy Savings Approaches Miss the Mark

In the last few years, there has been a cacophony of requests for regulation of the STB market. However, the regulations focus on STBs, which is all that most of the government regulatory agencies in the markets where this approach is being taken can affect. This approach risks regulating small amounts of energy savings to the detriment of the much larger savings potential that competitive markets and incentive programs could reach.

ENERGY STAR and the Lack of MVPD/Service Provider Participation

ENERGY STAR had a two-fold purpose for adding the service provider agreement: To provide some incentive for participation and to ensure that the MVPDs did not override the energy savings potential of the devices by forcing them to remain on all of the time. The traditional reason STBs remain on when not in use is so the MVPD can communicate with the device and deliver data to it, either hidden in the video stream or in a dedicated one-way data stream. The nature of one-way communication requires that the listener always be listening. To break this reliance, data should utilize a high-speed, high-reliability, two-way data connection to communicate when needed. The only entity in the STB ecosystem that could accomplish this is MVPDs, and not the box OEMs.

Creating that relationship with the MVPDs changed the conversation from reasons STBs need to be on 24x7 to what benefits the MVPD could realize by participating in ENERGY STAR. That the MVPDs have not been participating in ENERGY STAR is not reflective of the lack of benefits for doing so, but the costs, both perceived and real, of partnering but then having to break the partnership agreement when a new revision takes effect. That uncertainty and the long lead times from a purchase decision to fielding STBs into consumer homes diminishes the benefits of partnership. MVPDs are paying attention, and there has been a significant amount of pressure on OEMs to follow ENERGY STAR specifications for STBs, despite the lack of MVPD partners with ENERGY STAR. This pressure has resulted in a high rate of ENERGY STAR STB deployment despite the lack of MVPD participation.

So why are MVPDs pushing suppliers to follow ENERGY STAR levels, then buying these STBs in droves, while not participating in the ENERGY STAR program? The answer is very complex. Simplified, the history of telecommunications in the United States is intertwined with periods of regulatory excess, as well as with blatant rent seeking as part of so called "deregulation.". Throughout all of this, the regulation sources for the telecommunications industry have been at the federal, state, and local levels. Local in some areas can indicate an individual town (in Massachusetts, 351 individual town cable commissions regulate cable MVPDs). This regulatory structure has created all manner of interesting requirements on the industry over the years. ENERGY STAR is a government program, though it is not regulatory in nature and is wholly voluntary, and is seen as such by the industry. Regulators' requests to regulate to ENERGY STAR levels, especially immediately on the enactment of said levels that represent the best the industry has to offer, is not helping the situation.

Bulk of Per-STB Savings Limited in Large Part to Sleep State Adoption

The savings from more efficient hardware will begin to diminish over time. There is a limited amount of savings that can be derived from the active operation mode of STBs given the duty cycle (assumed 4-5 hours of active use per day) presumed and that as the active mode power goes down, the savings potential becomes smaller and smaller (ie; half of 20 watts is twice the size of a half of 10 watts). When active, an HD DVR with local high-speed and head end high-speed bi-directional networking requires a significant amount of power to drive the high-speed data connections, the HDD, and the video decoding. Much of the power used for these functions is not expected to improve in the coming year or two.

The successful implementation of significant and meaningful sleep mode (in which the sleep mode power uses an average of 3 watts) will likely account for 80-90% of the possible energy savings from models available today. There will be further energy savings, including savings from optimizing new and yet to be introduced features. New features tend to initially be available as not optimized from a power perspective in any given mode, but these savings will represent a fraction of what meaningful sleep promises for energy savings.

Fewer STBs per home. Decreasing the number of boxes per home will yield significant savings opportunities in both the use mode and for manufacturing. In the use mode, the decreased number of boxes will push other functionality into the gateway or multiroom box, leading to net savings. Savings will come primarily from embedding the STB client in the TV. This will add nominal power requirements to the TV (a watt or two, or 5 if the network interface is MoCa) while cutting an entire high-definition multimedia interface decode/encode loop from the content delivery (because the link from the content provider to the box to the TV is cut and the content goes directly to the TV).

However, selling fewer boxes is inconsistent with a strategy that only regulates boxes sold, as is the diminished impact any regulatory strategy will have that is focused solely on the boxes. Even if regulations are adopted by various governmental agencies, they will ultimately leave out a lot of possible energy savings.

Looking For a Win-Win Outcome

STB efficiency has come a long way, spurred by the technological advances and innovation documented above. The same can be said of the design of energy efficiency programs. Early energy efficiency programs consisted of simple lighting and appliance programs. As these markets began to transform through the combination of better technology, better program design, increased market activity, and a fundamental shift in consumer behavior, new avenues for energy savings were sought. Consumer electronics became the next market segment to implement successful programs, after a design was developed to benefit the right people in the supply chain.

The key to designing these programs hinged on the fact that the energy efficiency advocate, whether a utility, consortium, or service provider, was able to effectively negotiate with key supply chain market actors to obtain their participation to reach the desired impact on a market. For appliance programs, the advocate had manufacturers agree to upgrade technology in return for the advocate providing rebates to consumers that would offset part of the incremental cost increase. For lighting programs, advocates had an open market opportunity with manufacturers for premium in-store placement in exchange for a reduced cost of CFLs to consumers. For electronics programs, advocates had an agreement with retailers for them to change their television stocking practices in return for an incentive for each qualified TV sold.

There are many reasons why STBs have not had the success of other consumer products through the support of energy efficiency advocates, but the underlying reason is the lack of negotiation between energy efficiency advocates and MVPDs. This lack of communication and how it can be overcome is explored in the next section.

Regulate or Negotiate, that is Not the Question

In some ways, regulation is a negotiation that yields sub-optimal results. There are multiple ways to negotiate an issue. The Harvard Guide to Negotiation describes two negotiation approaches that are used to frame the following discussion (Luecke 2003):

- Distributive: the parties negotiate over the value of a fixed sum game. Also known as a zero sum game with win-lose outcomes.
- Integrative: the parties cooperate to achieve maximum benefits by integrating their interests into an agreement. The negotiations can result in win-win outcomes.

Distributive negotiations. In distributive negotiations, it is critical to control information. The party that knows more about their opponent's bargaining position and true preferences and weaknesses has a significant advantage. Proceedings that establish minimum appliance standards take on the win-lose dynamic of distributive negotiations. Energy efficiency advocates press for as much energy savings as possible, while the industry tries to protect the most energy consuming of products from regulation. Information necessary to establish an optimal standard—as defined by the benefit/cost goal—is withheld or strategically manipulated. This is especially true for product energy performance data (Lynch, Wylie & Kaplan 2010). Given the fast pace of change in the electronics industry, utilizing anything but current energy performance data is a disadvantage to energy efficiency advocates.

Distributive negotiations, and their paucity of information sharing, are also likely to lead to a natural focus on energy savings from a power-per-box perspective and negotiations with OEMs. In contract, focusing on energy savings on a per-subscriber or fleet-wide basis may better fit negotiations with MVPDs.

Integrative negotiations. The Harvard Guide to Negotiation explains that integrative negotiations take a different approach:

> *These negotiations require a different set of tactics, beginning with a slower, more exploratory opening. They rely on greater collaboration and information exchange. Unlike the win-lose tactics described earlier, where the focus is on claiming value, integrative deals aim to create and claim value.* (Luecke 2003)

A common win-win opportunity related to energy-efficient products involves a manufacturer spending more money to provide higher efficiency, then reaping the benefits of consumer recognition and possibly a higher product margin. With STBs, this opportunity is not as apparent for a number of reasons, including the lack of consumer choices and products, the lack of end-user ownership, and minimal energy savings related to the overall cost of the product or MVPD service (Lynch, Wylie & Kaplan 2010). By recognizing and boosting the reputation of the MVPDs, advocates may help in recruiting subscribers, but a direct correlation between improved efficiency and financial gain could be difficult to find.

For MVPDs, one type of win may be especially fruitful for integrative negotiations: reducing equipment or operating costs. The next section maps examples of potential MVPD wins through reduced costs to possible efficiency opportunities.

Incentives and Constraints

Negotiating to lose. Regulation is in many ways a form of negotiation, one that is distributive and yields a winner and a loser. The information sharing tends to be one sided, and the information that is communicated tends to be strategically manipulated in order to achieve the goal of averting any meaningful negotiation. It appears from the outside that regulators would have the upper hand in negotiations, because the bargaining position and true preferences and weaknesses for the industry appear to be readily obvious.

However, the truth is likely far from that assumption. Any regulations require a cost benefit analysis to justify the compliance. With the related costs of the network upgrades, the lack of knowledge of what has been designed but not yet publicly released, and the speed at which the modern consumers energy industry moves, the effectiveness of any proposed regulation is likely to be severely hampered.

The kneejerk response by the industry will cause little if any information sharing, which will likely extend to voluntary programs that target best in class and typically enjoy greater access to information.

Negotiating to win. Pursuing opportunities with MVPDs under an integrative approach may require a slower opening, in which incentives and constraints are explored before discussing possible solutions. However, the payoff include achieving energy savings that are not possible through a win-lose approach. Table 1 explores the typical concerns of energy efficiency program administrators and MVPDs. These concerns are likely to arise during negotiations. Probable answers to these concerns should be considered before engaging in negotiations. Nonetheless, a significant amount of time may be required for information sharing to fully understand the constraints of the MVPDs.

Table 1. Typical Concerns

Energy Efficiency Program Administrators	MVPD
Are there enough energy savings to justify pursuing a STB program?	Will a STB program hamper us being able to offer new and improved services to customers?
Will the measures pass required evaluation tests (e.g., benefit/cost, TRC)?	Will changes negatively impact consumers' experiences?
How can a STB program be designed without promoting freeridership?	How will this help our bottom line?
How can we implement a relevant, cost-effective program with rapidly changing technology?	How do we account upfront for potential changes in program design in the near future?
Energy Efficiency Program Administrators	**MVPD**
Is it worth considering STB programs when regulation may be eminent?	If this is voluntary now, will it be mandated (regulated) later?

Beyond The Box – The Network's Role in Energy Efficiency

The network and its effect on STBs represents another component of the energy efficiency potential of STBs. As a very simplistic primer, the traditional design of cable and satellite systems is broadcast: all boxes on a system access all the information for all of the boxes, and all subscribers decode the same encrypted, scheduled video stream. Conversely, with the Roku/AppleTV/Boxee type hardware (or software), a consumer receives a file/video stream that is encrypted for them and no one else, and this stream happens when the box/client asks. This is called unicast. Today's cable and telecommunication systems are a mix of broadcast and unicast. Satellite is primarily broadcast with some unicast features if a broadband connection is available.

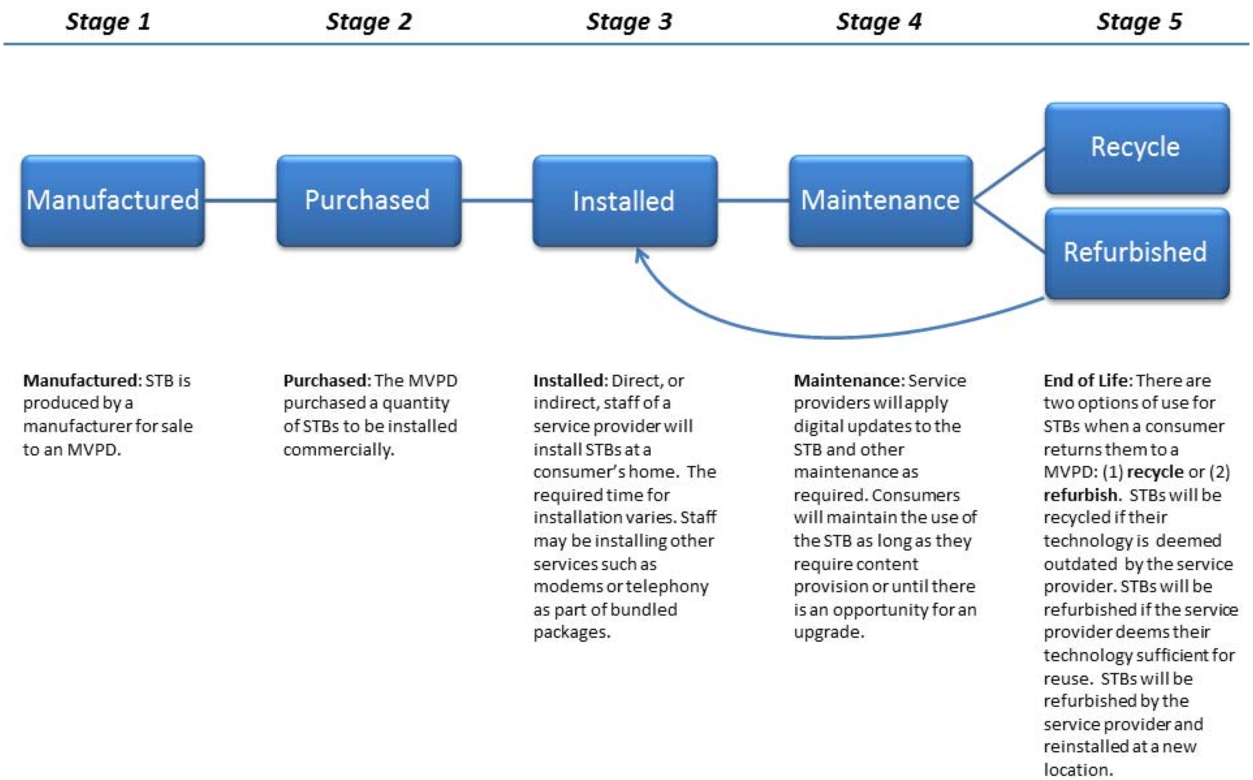
This distinction between broadcast and unicast underlies the network changes that are needed to accommodate meaningful sleep states. An STB cannot be in sleep mode while it listens for messages (or it needs to wake on a schedule). If a box is not listening for messages, then it can stay in a sleep state until the consumer uses it. The STB industry is considering short-term ways to allow boxes to wake on a schedule for messages. Then, if the cable and telecommunications industry is able to become exclusively unicast, there is little to no impediment for sleep in head end connected devices.

These changes are very costly and not trivial. To convert an entire cable system to unicast requires literally upending everything on the system, from the box to the datacenter distributing the video content. A mixed unicast/broadcast system is possible, but costs still exist that regulators will have little to no insight into.

Reducing Equipment or Operations Cost to Incentivize

Reducing equipment cost. There are two key decision points for reducing the cost for STB equipment and operation. The first is the purchase decision made by a MVPD (as represented by Stage 2 in Figure 2). In a hypothetical example in which a more efficient but more costly STB is available, a rebate on the efficient box could reduce the purchase cost to be lower than a less efficient STB, thus reducing the equipment cost of the MVPD. However, as the incremental savings on new STBs have dropped over the last decade, the energy savings available from purchasing a more efficient model has diminished. Thus, the level of justifiable rebate is also lower. A substantial majority of future power-per-box modal energy savings will likely occur through the implementation of deep sleep. To implement deep sleep in their fleets, MVPDs will likely need to invest in research and changes to their networks that will allow STBs to enter and remain in deep sleep. Unless these network changes reduce the cost for network maintenance and operation, the MVPD will not realize any savings.

Figure 2. Set-Top Box Lifecycle by Stages



The decision to retire or refurbish a STB, represent as Stage 5 in Figure 2, can be used to leverage relatively high energy savings for marginal incentives. When an STB is returned by a customer, either because it failed or they no longer need it, the MVPD must decide between refurbishing the unit and returning it to service or retiring the unit. The information they use to make this decision includes the cost of refurbishing or recycling, and the cost of replacing the old unit with a new unit. If the cost to replace the STB is higher than the cost to refurbish it, then they send it back into the field. Older STBs with the same features use more energy than newer STBs. Reducing the cost of retiring the STB through an incentive, which can potentially be small compared to the expected energy savings, could reverse this decision. Incentives should be offered only after understanding the current stock of STBs that a MVPD maintains, as well as their purchasing plans. Without the incentive, the STB would be retained in their fleet. Incentives should be tied to retiring specific models of STBs and replacing them with new models that have equivalent features and offer significant energy savings. STBs that are three to four years old may offer a good balance of knowing that they will be refurbished without some incentive with the size of the energy savings. Retiring units younger than three years will likely result in less energy savings relative to the incentive required[4], while incentivizing retiring units older than four years has a higher risk of freeridership.

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[4] Boxes that are 3 years old may only consume 20% more energy than a modern device but a 7 year old device may consume double thereby making the savings potential higher for older devices.

A longer term win-win strategy to reduce energy use and MVPD equipment and operations costs is to shrink the number of STBs required in a home be enabling them to service multiple TV sets. MVPDs would win because they have less equipment to maintain and support. Revenue through box rental fees may be lost, but overall reducing the number of STBs should cause a net gain.[5] Multiroom and gateway solutions are currently being offered by some MVPDs, and incentivizing or helping to promote these options are two ways that advocates can reduce the amount of STB per subscriber energy use. Opportunities to eliminate STBs from the home entirely, expect for a single home network gateway box, may be available through RVU-based TVs and other electronics.

Table 2. Everybody Wins

Energy Efficiency Program Administrators	MVPD
Multiroom and gateway solutions remove STBs from circulation and save energy.	Multiroom and gateway programs cover the costs of logistics to introduce multiroom solutions to market and retrofit existing STBs.
Upgrading legacy users to new STBs will save energy and remove inefficient STBs from circulation.	Upgrading legacy users to new STBs will provide them with the opportunity to purchase new premium priced services, such as Pay-Per-View and premium channels.
STB recycling programs ensure that old STBs are removed from circulation.	STB recycling programs will offset the operation costs for recycling old STBs.

As shown in Table 2, creating opportunities for MVPDs to upgrade the efficiency of a consumer's STB through incentives provided by energy efficiency program administrators represents another win-win strategy. Not every consumer has multiple STBs in their home. While the overall energy savings from implementing this strategy will be lower, the savings that are obtained are still significant enough to warrant a program. Negotiations between MVPDs and energy efficiency program administrators is essential to determine the metrics that will cause a potential STB replacement program to be labeled as win-win across the board, justifying its implementation. These metrics can be determined through pilot programs in which MVPDs are able to determine the revenue they can realize by upgrading consumers to a new STB with the support of energy efficiency program administrators. The administrators would cover a portion of the logistics and the cost of the upgrade to the more energy-efficient STB.

As with any energy efficiency program, there needs to be an understanding from an evaluation perspective on what will happen to the old product once replaced. This effects a program's net savings. Using integrative negotiations will allow MVPDs and energy efficiency program administrators to arrive at a solution that benefits both sides. Energy efficiency program administrators who implement STB recycling programs in which they cover the cost of recycling a turned in STB will offset the MVPDs cost of recycling STBs, and may impact their buying strategy. MVPDs do not have to pay for recycling the units, and it may be more cost-effective for them to upgrade to more energy-efficient STBs in a way that is a win-win for both parties.

Reducing operations cost. Energy efficiency program administrators could explore MVPDs network and head end energy consumption as it relates to the STB energy efficiency of the client

[5] The cost of a STB to a MVPD is only part of the overall cost. There is the cost of "rolling the truck" to deliver and install the device, ongoing maintenance costs, warrantees and other operational costs borne by the MVPD.

boxes and as a standalone issue. This is not wholly unrelated to the STB efficiency issue, and when dealt with holistically, the local energy efficiency program administrator may be able to leverage various energy efficiency programs into a package of incentives designed to decrease power consumption across the MVPD. The electric bill is second only to content licensing fees as a line item cost for MVPDs (Coblitz, 2012), so there is a significant amount of cost abatement potential that exists.

Conclusions and Recommendations

- The traditional power-per-box modal approach of selecting a more intra-mode power efficient model will have diminishing energy savings returns. A majority of the energy savings available on a per-box basis will be through implementing meaningful sleep mode power, which requires MVPD cooperation for network research and upgrades.
- A per-subscriber approach that views the STBs in a home as a system to be optimized offers a new wave of energy savings opportunities. Working with MVPDs can best be facilitated through integrative negotiations that seek win-win opportunities.
- Overall, MVPDs will be prominent in energy efficiency opportunities, while OEMs will have less of a role.
- Three opportunities that offer potential win-win outcomes are promoting early adoption of new technologies that reduce the number of STBs needed in a home, having a newer and more energy-efficient network delivery, and early retirement of older STBs.

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