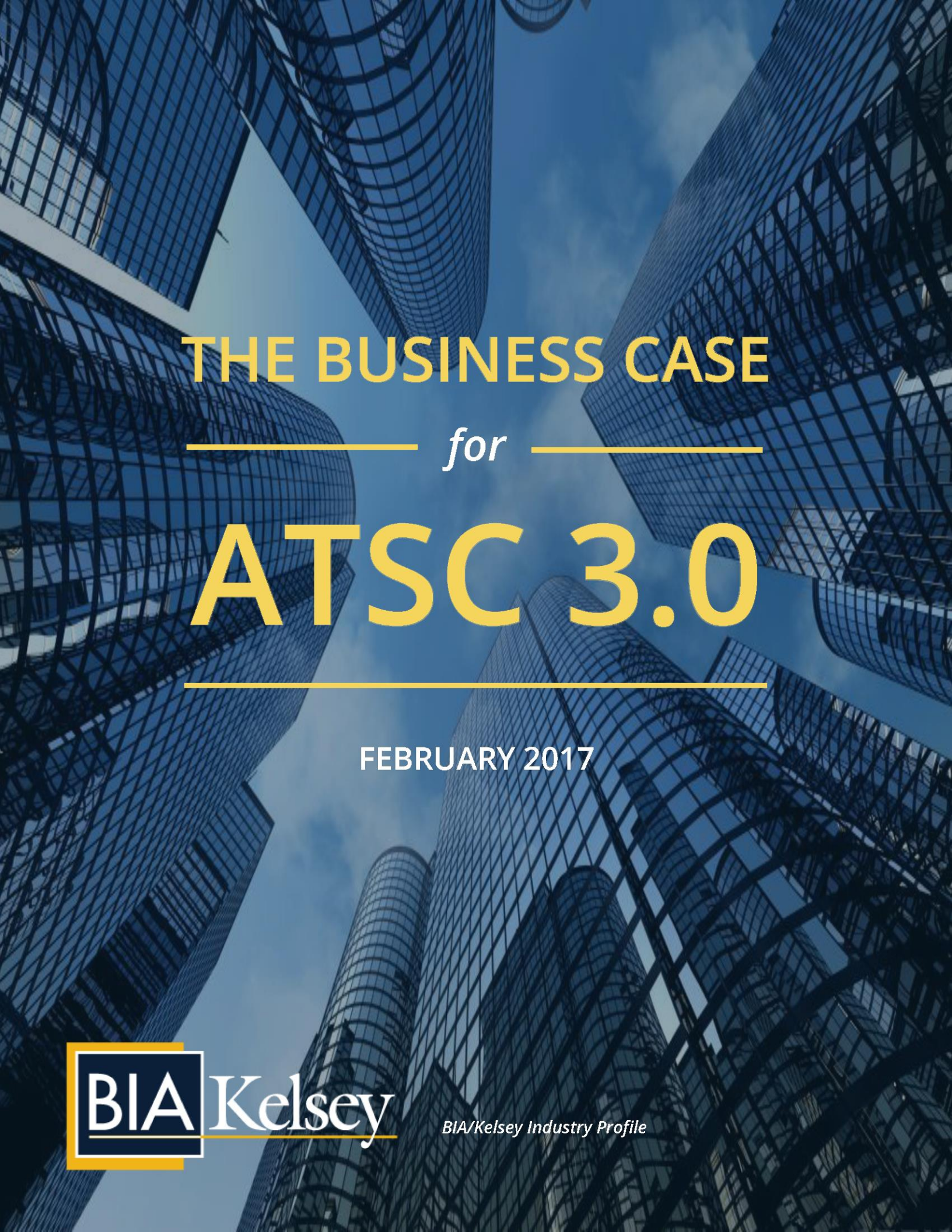

THE BUSINESS CASE *for* ATSC 3.0

FEBRUARY 2017

BIA Kelsey

BIA/Kelsey Industry Profile

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THE BUSINESS CASE FOR ATSC 3.0

Much has been written about the technical aspects of the transition from the current Advanced Television Systems Committee (ATSC) 1.0 standard to the proposed ATSC 3.0 standard and what will be required from an engineering perspective.

While it is important to understand what is necessary technically, the business implications are always central to major capital expenditure decisions. To explore the opportunity from this perspective, several questions are important to answer: *What are the costs? What are the benefits? What is the potential return on investment in a reasonable time frame?*

In the recent report, *TELEVISION BROADCASTING: Current Assessment and Future Outlook*, BIA/Kelsey conducted an in-depth review of the commercial television broadcasting business. The report reveals that BIA/Kelsey estimates the value of the aggregate, commercial television broadcasting industry is $84 billion, based on total gross revenue of approximately $31 billion for 2016. A key part of this positive assessment is that television has done an impressive job of diversifying and increasing its revenue streams in recent years. While about two-thirds of overall TV revenue comes from over-the-air (OTA) advertising (more than $20 billion), TV also generates over $7 billion from retransmission consent and more than $1 billion from online advertising.

Now, given a number of factors, including the conversion to the ATSC 3.0 standard, BIA/Kelsey estimates the aggregate value of the commercial television broadcasting industry could reasonably be expected to exceed $100 billion in the next five years, a potential 20% increase over our valuation today.

In this report, we make a more detailed analysis of the business implications of this conversion.

At the core of broadcasters' ATSC 3.0 expectations is the ability to offer a new internet protocol (IP) platform to better satisfy the changing needs of consumers and advertisers, allowing local television stations to further diversify their revenue mix and positioning them for sustainable growth and profitability. Just as the digital/internet era ushered in a vast new array of services, today's wireless

ecosystem is providing countless opportunities for innovative video entertainment and other applications.

A number of business objectives for the television broadcasting industry and its members are at the center of the ATSC 3.0 migration. Key **objectives** include:

1) Maintaining or increasing viewership by offering superior service to their viewing audience, including the delivery of a higher quality experience, more programming options, and ongoing innovation to accommodate expected (and unexpected) abrupt and hard-to-predict changing viewing patterns;
2) Raising advertising revenue through increased viewership, better ad targeting, dramatically expanded and more accurate viewership tracking, and a capability to better integrate multiplatform campaigns; and
3) Growing non-advertising revenue. This will involve the development of new IP-based broadcasting and non-broadcasting business models. As the business of television broadcasting morphs into a broader content distribution service, many new service offerings will evolve.

The other side of the equation involves the major broadcaster **concerns** related to the ATSC 3.0 conversion. These include:

1) Determining the overall capital cost and the ability to fund this new standard to adequately serve major broadcasters' customers, both old and new;
2) Providing uninterrupted service to their existing audience with a new technology that is not compatible with the current standard, requiring channel sharing and build-out of an ecosystem with new receivers for consumers; and
3) Determining the relevant time frame for transition. This is complicated by the lack of ATSC 3.0-compatible consumer devices and ATSC 3.0 receive chips in cellphones and other mobile devices, and delays that will occur related to post-auction channel repacking.

In this report, we review the likelihood that the implementation of ATSC 3.0 will allow broadcasters to achieve their objectives and analyze how to address their major concerns. Highlighting the environment that local television stations face

will begin our analysis, with special emphasis on the negative TV viewing trends ATSC 3.0 will help counter.

We next describe the advertising competition local television stations face, setting the stage for where we think local television stations will see increases in revenue. A discussion of future business opportunities for local television stations follows.

Finally, we present the business model for implementing ATSC 3.0 based upon our assumptions of the speed of introduction and acceptance by consumers, advertisers and other players in the media ecosystem. Our overall assessment is that the introduction and implementation of ATSC 3.0, while challenging and time consuming, will lead to a large improvement in the fortunes of the vast majority of local television stations.

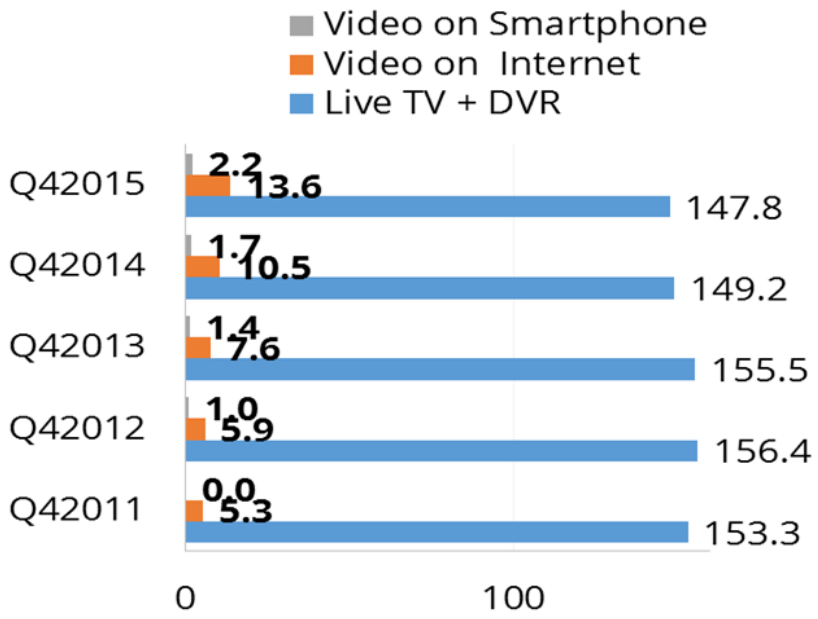
ANALYSIS OF VIEWERSHIP TRENDS

To assess the potential to maintain or increase viewership, we look at the current level and trends in this domain.

Consumers have never had more choices for video entertainment and information/news. This includes hundreds of cable/satellite-delivered networks, additional OTA program streams delivered by digital multicast signals of local television stations and streaming services providing video programming.

While there are numerous options now available to view video, the vast majority of viewing is of live television programming delivered by either local television stations or multichannel video programming distributor (MVPD, i.e., cable and satellite delivered programming services)-delivered networks. Figure 1 shows the average monthly hours of viewing by type for the fourth quarter of each of the past five years.

Figure 1 – Monthly Time Spent by Medium (4th Quarter)



(Nielsen Media Research)

Live television, which includes local television stations as well as national cable networks, decreased from 96% to 90% of all viewing over this period. Watching videos on the internet increased 159% over this same period, and viewing videos on smartphones grew 120%. While the raw numbers are still relatively small, the trends are quite clear.

As expected, younger age groups — teens and adults aged 18 to 24 — watch the most hours of internet and mobile video, followed by adults aged 25 to 34. Greater viewing of both internet and mobile video by these younger demographic groups presents significant issues for local television stations as these groups are some of the most coveted by national and local advertisers.

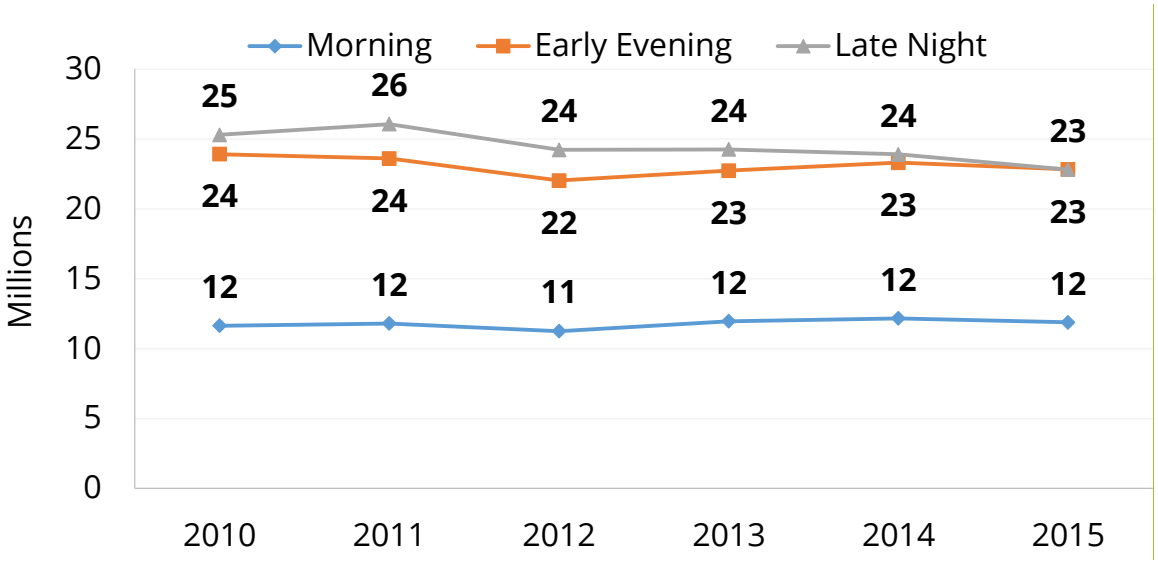
The expansive growth in YouTube, Netflix, Hulu, Amazon Prime Instant Video, HBO NOW and other video streaming services is also having a direct impact on live television program viewing. Between year-end 2010 and present, the number of Netflix subscribers has increased nearly five-fold. In April 2016, Netflix had 47 million subscribers in the U.S., and we expect that number to have reached 50 million at the time of this report. According to some estimates, the number of Amazon Prime Access subscriptions is more than 50 million and growing quickly.

Hulu has also seen substantial growth, reaching more than 12 million subscribers as of May 2016. Hulu, however, is owned by traditional TV networks (ABC/Disney, Fox and Comcast) and streams many full episodes from the traditional TV networks the day after they air. The bottom line is a number of competitors to live OTA television are growing rapidly and will continue to fractionalize viewing.

Competition for Viewing News

One of the most important areas of programming local television stations offer is local news. In addition to generating audience and providing an image for the station in local markets, advertising revenue from local news programming is substantial. According to an RTDNA/Hofstra University annual survey, news revenue rose from 39.7% of the stations' total revenue in 2002 to 51.4 % in 2014. However, as shown in Figure 2, there has been a slight, but noticeable, downward trend in television news viewing especially in late hour news programming.

Figure 2 – Local Viewership Trends of Broadcast TV News Programming



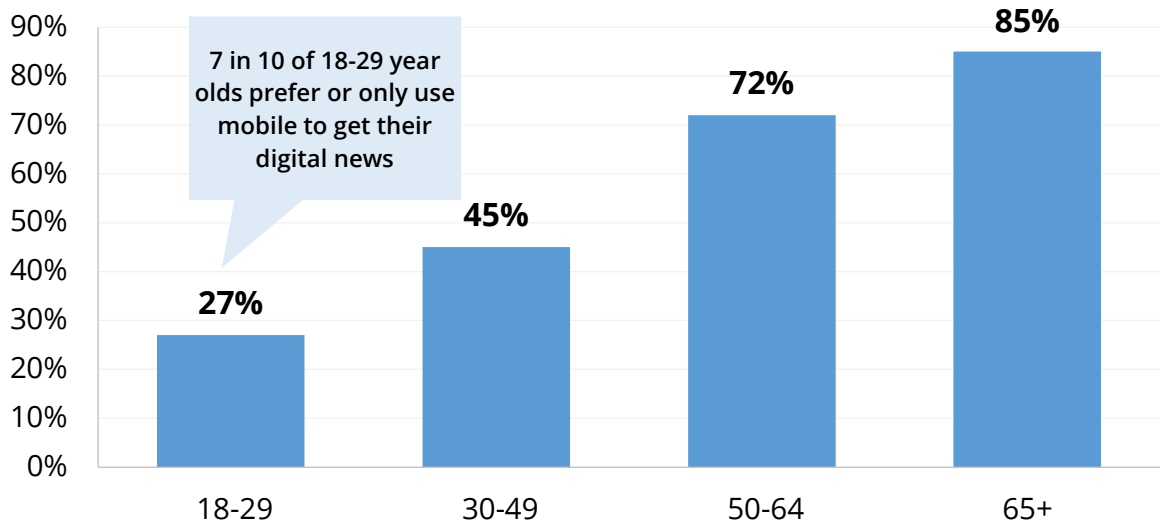
(Nielsen Media Research)

A major reason for the decrease in news viewing (in addition to more competition) is the rapid adoption of mobile devices — smartphones and tablets — that serve as an alternative or complement to watching the news. According to a Pew Research Center survey, smartphone ownership among adults has grown

from 35% in spring 2011 to 64% as of October 2015. An increasing number of consumers are accessing news via their smartphones: 68% use their phone to follow breaking news at least occasionally, and 33% do so frequently.

The reliance on local television stations varies considerably for different age groups. A July 2016 study by Pew Research Center demonstrates that quite dramatically. Figure 3 shows the responses for the different age groups to whether they "often get their news from television." Clearly younger adults rely on other sources besides local television stations to obtain their news and information.

Figure 3 – Percent of Consumers Who Often Get Their News from Television, by Age Group



(Pew Research Center, July 2016)

Effect of ATSC 3.0 on Television Viewing

It is clear from this overview that it will be difficult for television broadcasting to maintain or increase its viewership without some major change in its offering. Four areas in which ATSC 3.0 can help broadcasters accomplish this goal are to improve the viewing experience, expand the volume of relevant and compelling programming, allow for viewing on multiple devices, and displace or adequately compete with MVPD devices in the home.

I. Improve the Viewing Experience

ATSC 3.0 will enable television broadcasters to bring a theater-quality experience to every consumer's home, combining ultra-high definition (UHD) and high dynamic range (HDR) video quality with high-end audio capacity. HDR is a technique that expands the contrast ratio and color palette to deliver a more realistic natural image than is possible with current HDTV. HDR imaging brings even more life-like visuals to the ATSC 3.0 picture, further enhancing the experience of watching a 4K UHD TV show.

Enhanced audio features will also improve the viewing experience as sound and music are vital in the full immersive media experience. Expanded audio capabilities will let viewers personalize their screen time, bringing to broadcasting many of the features that are available on some DVDs. Smart features will also provide loudness controls tied to the unique sound environment in which viewers are watching and listening.

II. Increase the Amount of Programming

In addition to an enhanced viewing experience, ATSC 3.0 will allow access to more personalized programming. Geo-targeting of news, weather and advertisements will enable broadcasters to narrowcast certain programs to better satisfy their audiences and provide greater efficiencies to advertisers.

Also, while many broadcasters currently offer one or two channels of multicast programming along with their primary programming, the ATSC 3.0 standard and improved compression will allow a station to significantly increase the number of other programming streams it can provide. This opens the possibility to offer subscription services in addition to advertiser-supported programming.

ATSC 3.0 can combine onto one screen many of the features now being delivered (often at considerable expense, e.g., smartphone data plans) via second-screen services. With its increased data carrying capabilities,

ATSC 3.0 will deliver ancillary or interactive information about a program such as sports statistics or actor back stories that is now seen on a smartphone or tablet viewers use while watching a show. A return path via the internet will let viewers access recorded versions of live programs missed and video-on-demand (VOD) services to be sent to their smart TV, tablet, PC or phone.

III. Seamless Integration With Mobile and Other Devices

As illustrated in the viewing trends section, audiences have demonstrated an appetite for, and comfort level with, the multiple digital devices and services now available to them. They like the options and control that they can customize to their own needs. They are simultaneously using mobile phones and tablets and pursuing personalized and interactive advertising and on-demand news and entertainment. Consumers are inventing their own ways to create these services in an integrated viewing experience. ATSC 3.0 helps bridge internet and broadcast platforms into more seamless experiences.

A primary goal of ATSC 3.0 is to provide TV service to both fixed and mobile devices. Multiple types of TV receivers are being developed, including fixed devices (such as traditional living room and bedroom TV sets), handheld devices, vehicular screens and portable models.

IV. Displace MVPD in Additional Homes

Enhanced OTA broadcast content, coupled with over-the-top (OTT) broadband services, is seen by some consumers as a compelling substitute for high-priced pay TV services. Over the past five years, more than 3 million American homes have canceled their cable subscriptions, and a growing number have signed up for online streaming services to control when, where and how they watch their favorite shows. According to Nielsen, in the past couple of years, cord cutting has increased exclusive OTA viewing in the U.S. from 9% to 11% of television households. This process will be further enhanced as many

of the cable/satellite delivered networks lose subscribers and have less money to invest in new programming.

Interestingly, the possibility of ATSC 3.0 increasing consumer cord cutting is a two-edged sword for local television stations. As mentioned earlier, local television stations earn a substantial amount of revenue from cable and satellite delivery systems' retransmission consent payments. If cord cutting grows, those payments may decrease.

Mitigating those decreases might be the increased fees local television stations could negotiate as MVPDs will need to carry these stations.

REVENUE IN AN ATSC 3.0 ENVIRONMENT

The primary source of revenue for television broadcasters is advertising. The ability to generate advertising revenue is mainly a function of the size and demographics of the audience delivered and the ability to meet the specific targeted demographic needs of advertisers. These advertisers have been using television for many years as a primary vehicle to get their message to broad audiences.

However, advertisers have many options today for getting that message out, much as the consumer is subject to nearly ubiquitous messaging.

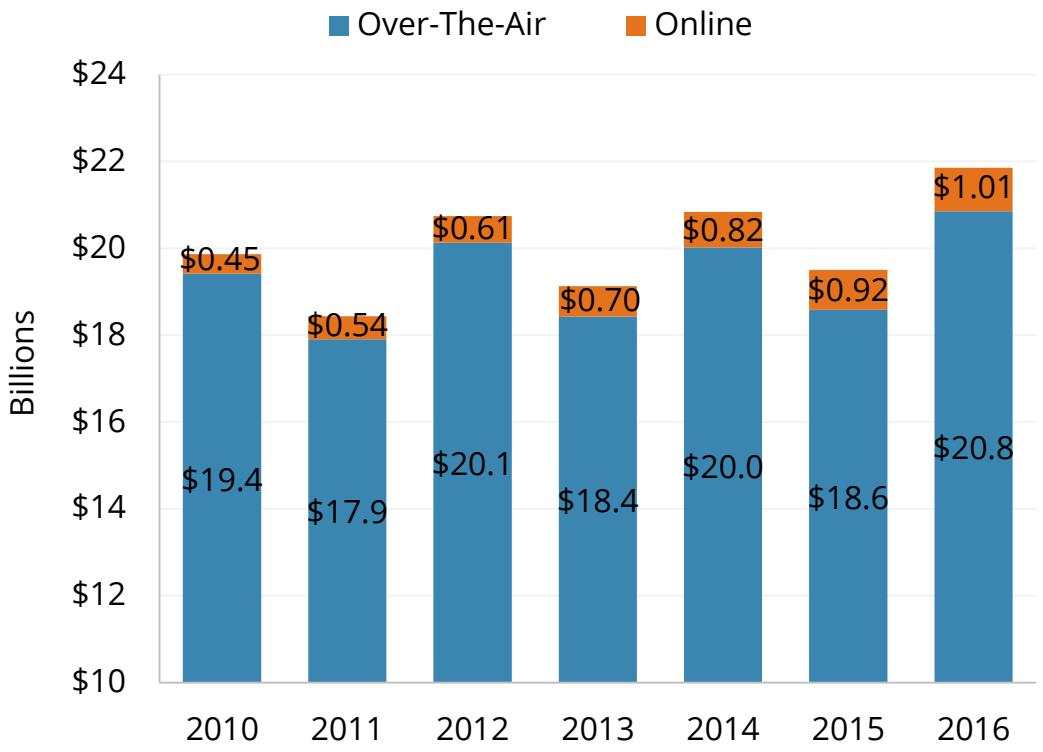
Advertisers are using digital/online media to a much greater extent and have been employing cross-platform strategies in planning and buying media for some time. Rather than building a media plan around individual media channels, advertisers are developing and executing integrated campaigns designed to run across various screens, including TV sets, tablets and PCs, mobile devices, and even other devices such as out-of-home digital video displays. They are also using big data to geo-target more well-defined audience groups.

To analyze television advertising and the opportunity to grow it in an ATSC 3.0 environment, we begin with an overview of television trends in advertising.

Television Advertising Revenue

As described, there has been a downward trend in viewing due to increasing competition, primarily on the digital/online side, and a shift in viewing habits. Despite this, as shown in Figure 4, estimated television advertising (including digital/online advertising) has increased from $19.85 billion in 2010 to $21.81 billion in 2016.

Figure 4 – Historic Television Advertising



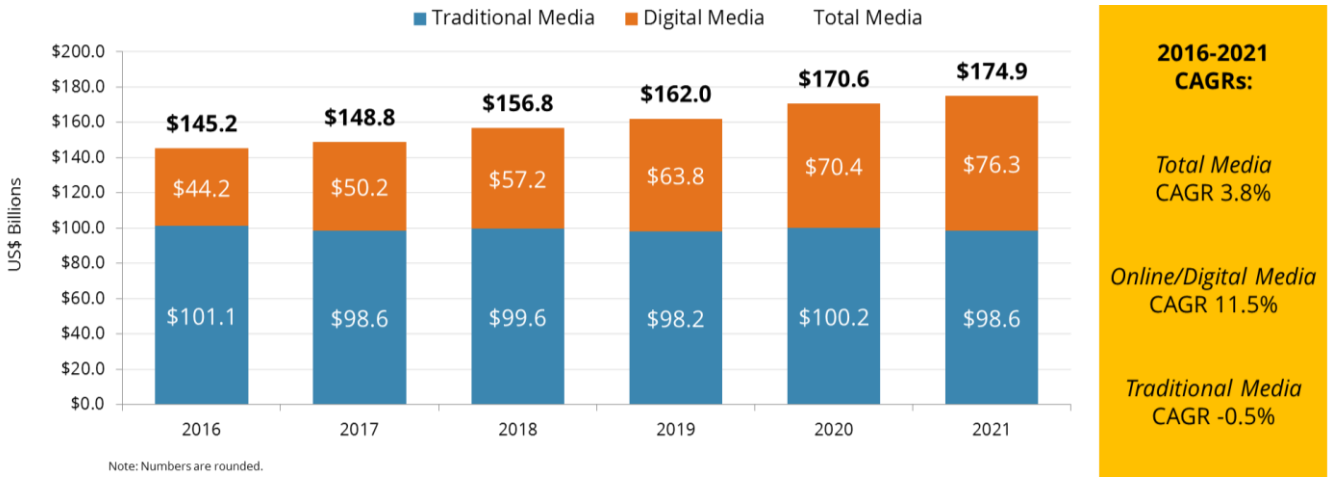
(BIA/Kelsey, 2016)

This increase is somewhat misleading, as 2016 was a presidential election year, and political advertising significantly affects year-to-year advertising revenue changes in the television industry. Examining a four-year moving average of OTA television advertising, it appears the trend has been positive since 2012 and in the 1% to 2% range in recent years. In other words, despite the year-to-year fluctuations and the decrease in viewership, television advertising has been growing, but at a slow positive rate.

Total Local Advertising Revenue

As we look at television advertising going forward, we regard it as critical to take into account the entire local advertising ecosystem and the trends under way. As illustrated in Figure 5, BIA/Kelsey estimates total local advertising will be $148.8 billion in 2017 and grow to $174.9 billion in 2021.

Figure 5 – Projected Local Advertising



(BIA/Kelsey, 2016)

Of particular note, BIA/Kelsey projects all the growth in local advertising to be in digital/online media. The modest decline in traditional media reflects the continuing downturns in print media, coupled with low growth rates in other formerly fast growing traditional media.

The biggest growth is projected for mobile advertising, followed by pure play digital/online. The implication for television broadcasters is that they must expand their digital/online presence, while continuing to satisfy traditional advertisers, many of which are pursuing a cross-platform campaign.

ATSC 3.0 Effect on Television Advertising Revenue

If the increase in viewing from the enhanced experience and multicast channel programs occurs, the television industry will be able to justify higher advertising rates and/or offer advertising on more programs and devices.

With ATSC 3.0, we expect broadcasters will serve audiences not only from their primary broadcast platform, but also from other IP-based platforms. Many broadcasters already use additional digital channels such as social, mobile and internet to drive even higher value overall for their broadcast advertisers' cross-platform campaigns. With ATSC 3.0 these initiatives will become even more tightly integrated.

The ability to target potential purchasers via big data analytics and attribution tracking has been a major advantage of digital/online advertising. Eliminating the cost of reaching unresponsive consumers is vital to efficient advertising. ATSC 3.0 will introduce into the TV experience the same kind of targeting power that digital/online advertising has implemented.

Geo-targeting and customized marketing campaigns are well suited to the capabilities of ATSC 3.0 broadcast delivery. Broadcasters see that having the ability to compete with cable to offer audience-targeting beyond gender/age demographics for advertising is critical. For advertisers, this will provide a new set of competitive choices to target ads to their relevant geographic service areas.

Advertisers can provide added information to accompany their video commercials, increasing the value to customers with personalized updates. They can also get near real-time analytics of how and by whom content is used. This can allow the advertiser to create loyalty programs and offer special bargains directly tied to television advertisements. Some have suggested that the ability for viewers to provide their gender, age and ZIP code and get tailored advertising over the air, is one of TV's holy grails.

DEVELOPING NEW BUSINESS MODELS

ATSC 3.0 can best be thought of as a huge IP pipe that can be broken into many smaller pieces to deliver individual streams of different content and service. One or more of the streams will be used for video programming. The use of the remaining spectrum will be determined by the broadcaster and represents an important opportunity to diversify their revenue streams and open up new income possibilities. The amount allocated for video programming and other uses

will be based on a number of considerations, including local market service and what is the highest and best use for a given portion of this bandwidth capacity.

Video Programming*—*The core offer of the broadcast station. Depending on its type (network affiliate, independent, specialty language, etc.), a station may or may not offer UHD as its primary programming. Instead, the station may provide a variety of other multicast channel programming for niche audiences. The operating philosophy of the broadcaster may result in as little as 3 to 5 Mbps of capacity (10% to 18%) or as much as 20-plus Mbps (75%) allocated to video programming. The balance would be available for other applications.

Other Applications* —*Use of a portion of the bandwidth for non-video programming purposes. As an IP-based technology, ATSC 3.0 will position broadcasting as a central player in the evolving communications infrastructure. IP means the technology is compatible with all other delivery platforms, including the popular streaming media video services. IP opens up a much easier way to deliver content that can be stored and played back on a consumer platform when desired. With its point-to-multipoint distribution capability, broad geographic coverage and potentially large bandwidth available for other applications (as much as 10 to 15 Mbps in some cases) ATSC 3.0 television will be an attractive alternative to the internet and cellular for certain applications.

Datacasting* —*The ability to send targeted, encrypted content to specified receivers will be greatly enhanced by this new standard. Taking advantage of broadcasting's inherent point-to-multipoint nature, large videos and digital files can be sent directly to fixed and mobile devices and will have improved building penetration. This will allow for expanded educational, commercial and public safety applications. SpectraRep, a BIA/Kelsey affiliate, has been successfully demonstrating and deploying datacasting solutions for public safety entities using ATSC 1.0 to date, but ATSC 3.0 will make it much more valuable for this application, as well as commercial applications.

Content Distribution and Edge Storage* —*Cisco estimated that three-fourths of the world's mobile data traffic will be video by 2019 and that mobile video will increase by 13-fold between 2014 and 2019. ATSC 3.0, with its new

integrated internet and broadcast technology platform, can provide a new set of services in exactly the same time frame that the bandwidth demand for mobile video will be exploding.

ATSC 3.0 can satisfy much of the one-to-many mobile video data traffic demand that is so popular among consumers. Broadcasting spectrum can deliver popular content such as movies far more efficiently than mobile data infrastructure. This can alleviate some of the overall challenge of providing mobile bandwidth intensive services, such as video, to a public with an ever-growing appetite for video.

The ATSC 3.0 technology allows content distributors to put video on the most efficient IP network, offloading capacity problems for highly viewed events, similar to current tactics for Wi-Fi offloading. Major content distribution network operators such as Akamai have informed broadcasters of their commercial interests in this capacity and willingness to pay for it. Broadcasters may partner to offer this service or lease out the capacity to companies in the content storage and distribution space.

Home Internet of Things (IoT) Gateway ***—Your home is filling up with IoT devices like thermostats and security cameras that connect via Wi-Fi.*** In addition, there are printers, scanners, tablets, smartphones, DVRs, games, smart TVs and other TV appliances in one's home network. ATSC 3.0 television can be an integral part of this network, allowing machine-to-machine communications in which multiple devices interact with OTA TV and each other at home and away via the internet.

At the National Association of Broadcasters convention in Las Vegas last April, LG Electronics demonstrated an "ATSC 3.0 Wireless Network Antenna," essentially a standard home Wi-Fi router with an ATSC 3.0 (and ATSC 1.0) tuner. It has a built-in, electronically steerable "smart" antenna that can distribute programming to multiple devices throughout the home. Every IP device in the home's LAN coverage area will have access to everything OTA and internet. ATSC 3.0's flexible transmission system would also allow for the delivery of IoT software and firmware updates to vehicles and appliances.

***Other* — The distribution advantages of ATSC 3.0 television broadcasting will allow for a wide variety of other applications.** This has implications for the development of business models related to building maintenance, agriculture, digital signage, continuing education, audio services and other to-be-developed opportunities. As ATSC 3.0 becomes a reality, we expect numerous other business cases to evolve.

ATSC 3.0 will also provide consumers with a new and advanced Emergency Alert System called the Advanced Warning and Response Network (AWARN). This service can transmit emergency alerts and event-specific information to hundreds of millions of devices simultaneously. It will deliver multimedia alerts (utilizing video, audio, text, websites and graphics) to ATSC 3.0-equipped cellphones, tablets, laptops, netbooks and in-car navigation systems, including a "wake-up" feature that can turn on a device in times of extreme emergencies. It leverages the higher data throughput to deliver mass, instantaneous distribution of emergency messages even when cellphone systems fail or electric power is disrupted.

COST OF DEPLOYMENT

Initial estimates suggest each station will spend between $300,000 and $600,000 to install ATSC 3.0 capabilities. This price tag includes installation and equipment such as a new exciter and mask filter, studio-to-transmitter link modifications, test equipment, and audio and video encoders. The new exciter will be key to this upgrade, and GatesAir has developed one designed to support ATSC 3.0 as a software upgrade from ATSC 1.0.

Those stations that wish to provide 4K UHD and other advanced features will incur additional capital expenses to upgrade their studios and master controls. Since this will happen at about the same time as the post-spectrum auction channel repacking, it's possible that repack reimbursements from the Federal Communications Commission could help broadcasters with some of the ATSC 3.0 expenses.

Broadcasters will also have the option to build single frequency networks (SFNs), which can extend or improve existing coverage, particularly for indoor and mobile device reception. SFNs can be used in urban or mountainous areas to fill in OTA coverage on a single channel. Ordinarily, the interference generated by two stations transmitting at close proximity on the same channel makes this impractical, but ATSC 3.0 incorporates technology to minimize this. SFNs can also enable geo-targeted advertising. SFNs will be an important upgrade for many broadcasters, maximizing the benefit of ATSC 3.0 conversion.

IMPLEMENTATION AND TIMING

Like mobile carriers today, which are free to choose when and how to deploy new standards, broadcasters will have the option of determining when and whether to enhance their current service with ATSC 3.0. A number of factors, however, will influence the timing of implementation.

A major concern is that this new standard is not backward compatible, and the FCC will not give broadcasters second channels on which to operate the new format as it did during the transition as it did with the ATSC 1.0 transition. This also means that consumers do not currently have existing television sets and mobile devices capable of receiving ATSC 3.0 transmissions. Another complicating factor is that the FCC is in the process of taking back television spectrum through its reverse auction proceeding and its implementation and the channel repacking that follows will be disruptive. As such, the introduction of ATSC 3.0 will require development of a transition plan for all television broadcasters.

Since it won't be possible to broadcast ATSC 1.0 and ATSC 3.0 on the same transmitter, a petition filed earlier this year by the National Association of Broadcasters, the Consumer Technology Association, America's Public Television Stations and others proposes a transition period allowing simulcasts of programming in the original ATSC 1.0 format on some transmitters and ATSC 3.0 programming on others. Broadcasters in each market will need to devise plans for some extensive channel sharing in which some multi-station transmitters use ATSC 1.0 and others use ATSC 3.0.

A likely scenario gaining broad acceptance is to set up a temporary channel-sharing partnership featuring a "lighthouse station." One station (the lighthouse) provides ATSC 3.0 signals for all stations in a market, while other stations make unused capacity collectively available to replicate the lighthouse station's ATSC 1.0 signal.

Over time, as audiences transition their viewing to the ATSC 3.0 services, these stations will elect to convert all of their respective transmissions to ATSC 3.0 and no longer transmit an ATSC 1.0 signal. Station brand identity will be maintained by channel identification that is now present in ATSC 1.0 and will continue to be present in ATSC 3.0. As such, all viewers would be able to receive programming from their local stations in both the current DTV and new TV formats throughout this transition period, and broadcasters will be able to maintain their identity and loyal audience following.

Another major concern affecting timing is that since ATSC 3.0 is not backward compatible with the current standard, consumers will be required to buy new receivers or tuners. Top TV suppliers, such as LG, have already publicly demonstrated ATSC 3.0 prototype receivers in several form factors. Other top TV suppliers, such as Samsung and Sony, have contributed heavily to the standard. LG, the NAB and others have also been involved in developing and demonstrating home gateways to allow home reception on smart TVs and IP-enabled devices.

A factor positively impacting the availability of devices is the upcoming 2018 Winter Olympics in Seoul Korea. The Korean Communications Commission acting on behalf of the Korean broadcasters, adopted ATSC 3.0 in 2016 so that the 2018 Olympics could be broadcast in UHD 4K. With the advantage of a second transmission channel, these broadcasters are currently building out transmission facilities and have committed to begin broadcasting with ATSC 3.0 by mid-2017.

Several set manufacturers have announced that they will be offering ATSC 3.0-compatible UHD television sets and other receiving devices in 2017. A US transmitter manufacturer is currently in the process of delivering the transmission equipment while other US and Korean companies are providing the rest of the infrastructure equipment needed to commence broadcasting.

Similarly, there is concern about the timing of OTA TV chips in cellphones. Broadcasters have elected not to pursue legislation to have these chips in cellphones, believing that demand in the marketplace will force manufacturers to build these chips in their phones. Instead, they expect consumer demand and competition among carriers will lead manufacturers to include the chips soon after they are introduced in the 2017-2018 time period.

The FCC reverse auction proceeding is expected to be completed in the next couple of months. This will determine which stations turn in their channel allocations and which channel share with other station partners. The channel repacking determination that follows will be disruptive and will take a few years to play out.

Those stations forced to repack will have the perfect opportunity to acquire transmission equipment that is ATSC 3.0 upgradable or compatible without having to spend their own capital. This adds an additional layer of complexity to the timing and determination of how and when to fund the ATSC 3.0 build-out.

COST-BENEFIT ANALYSIS

The information presented in the previous sections provides the basis for evaluating the business case for ATSC 3.0. Utilizing BIA/Kelsey nationwide and local market data, cost estimates, and other data, we assess the financial implications. The following represents the inputs and rationale for assumptions in this evaluation.

Build-Out Costs

As previously discussed, the build-out costs for ATSC 3.0 are estimated at between $300,000 and $600,000, assuming no reimbursement from the government related to the post-auction channel repacking. We project this is the amount a station would need to spend on capital expenditures.

Assuming all 1,287 full power commercial stations in the U.S. spend the maximum estimate of $600,000, the total build-out costs for the industry would be approximately $772 million. We predict not all stations will spend the maximum,

with non-affiliates and other small market stations opting for the $300,000 minimum build-out cost. Based on the projection that only the network affiliates of the big four networks and stations with annual revenue of more than $25 million will make the maximum build-out investment, we conclude that the total ATSC 3.0 build-out costs for the industry will be just over $600 million. Our expectation is that the bulk of these costs will be incurred starting in 2017 and running through 2019.

Advertising Revenue

The incremental revenue to be derived from advertising will come from the different benefits to consumers and advertisers described in this report. In particular, we believe television stations in an ATSC 3.0 environment will see advertising revenue grow due to increased viewing of primary programming (on television sets and/or mobile devices), offering additional multicast channel programming, expansion of cross-platform advertising capabilities, and improved metrics and targeting for advertisers.

As previously described, monthly live TV and DVR viewing has declined in recent years. If this trend continues, we estimate monthly viewing will decrease to 145 hours in 2017 and 144 hours in 2018. Beginning in 2018, we expect the advantages of ATSC 3.0 to offset this downward trend. If the better experience and ability to view TV programming on multiple mobile devices were to increase primary program viewing by one hour per week, hourly viewing in 2018 could rebound to 2015 levels.

Given the relationship between OTA television advertising and annual hours of viewing, this extra hour per week would translate into an incremental $670 million in annual ad revenue for the television industry. Realistically, there won't be enough ATSC 3.0-enabled devices available in 2018 to drive these dollars, but it could represent incremental annual revenue gain for the industry from primary programming in 2020 and beyond.

Incorporating this concept into a more grounded approach, we initially look at the cost-benefit of ATSC 3.0 at an industry level. The build-out costs have been projected above, and the incremental advertising revenue is the area most easily estimated. In this analysis, we utilized the projected annual viewing hours and

BIA/Kelsey forecast advertising revenue for the industry and assumed the following:

1) The bulk of ATSC 3.0 build-out will begin at the end of 2017 and run through 2019.
2) Hours of primary program viewing will increase gradually over time to 3.0% (approximately 1 additional hour per week) in 2023.
3) Additional multicast program viewing will increase gradually over time to 1.5% (approximately an additional 30 minutes per week) in 2023.
4) Digital revenue will increase gradually up to a 10% premium over the projection period as stations offer more advertising on multiple devices.
5) There will be an advertising premium due to targeting and cross-platform capabilities growing to 5% by 2023.
6) There will be a decrease of up to 3% in projected retransmission consent revenue starting in 2018 and running through 2023.

The resulting incremental advertising revenue is shown in Figure 6.

As shown, based on these assumptions, we estimate incremental annual advertising revenue from increased viewing for the industry to grow from $120 million in 2018 to $2 billion in 2023.

Figure 6 – Incremental Industry Ad Revenue from ATSC 3.0

All Dollars in Billions	2017	2018	2019	2020	2021	2022	2023
TV OTA Ad Revenue	$ 19.8	$ 21.0	$ 20.7	$ 22.8	$ 22.1	$ 22.0	$ 22.8
TV Online Ad Revenue	$ 1.1	$ 1.2	$ 1.3	$ 1.4	$ 1.5	$ 1.6	$ 1.7
Total TV Ad Revenue	$ 20.9	$ 22.2	$ 22.0	$ 24.2	$ 23.6	$ 23.6	$ 24.5
Est. Monthly Viewing (Hours)	145.0	143.6	142.2	140.8	139.4	138.0	136.6
Est. Annual Viewing (Hours)	1,740.0	1,723.2	1,706.4	1,689.6	1,672.8	1,656.0	1,639.2
Assumed Primary Program Viewing Gain		0.2%	0.5%	1.1%	1.7%	2.3%	3.0%
Increase Primary Program Annual Hours		3.4	8.5	18.6	28.4	38.1	49.18
Incremental Primary Revenue		$ 0.04	$ 0.11	$ 0.27	$ 0.40	$ 0.54	$ 0.74
Multicast Program Viewing Gain		0.0%	0.4%	0.6%	0.9%	1.2%	1.5%
Increase Multicast Hours		-	6.8	9.3	14.2	19.0	24.6
Incremental Multicast Rev		$ -	$ 0.04	$ 0.07	$ 0.10	$ 0.14	$ 0.18
Digital Revenue % Increase		1%	3%	5%	7%	9%	10%
Incremental Digital Revenue		$ 0.01	$ 0.04	$ 0.07	$ 0.11	$ 0.14	$ 0.17
Revised Total TV Ad Revenue	$ 20.90	$ 22.26	$ 22.19	$ 24.60	$ 24.21	$ 24.42	$ 25.59
Advertising Targeting Premium		0.5%	1.0%	2.0%	3.0%	4.0%	5.0%
Total Revised Television Ad Revenue	$ 20.90	$ 22.37	$ 22.41	$ 25.09	$ 24.93	$ 25.40	$ 26.87
Less: Retrans Consent Revenue Lost	$ -	$ (0.04)	$ (0.09)	$ (0.15)	$ (0.22)	$ (0.30)	$ (0.35)
Incremental Ad Revenue Gain	**$ -**	**$ 0.12**	**$ 0.32**	**$ 0.74**	**$ 1.11**	**$ 1.50**	**$ 2.01**

(BIA/Kelsey, 2016)

To determine the cost-benefit of the implementation of ATSC 3.0 at an industry level, we combined the incremental ad revenue, less the associated operating costs, with the build-out costs. As shown in Figure 7, the resulting return on investment was calculated to be 40%.

Figure 7 – Industry Return on Investment from ATSC 3.0

Dollars in Billions	2017	2018	2019	2020	2021	2022	2023
Incremental Ad Revenue Gain	-	0.12	0.32	0.74	1.11	1.50	2.01
Associated Operating Costs @ 25%		(0.03)	(0.08)	(0.19)	(0.28)	(0.38)	(0.50)
Incremental Pre-tax Profit		0.09	0.24	0.56	0.84	1.13	1.51
Estimated Taxes (40%)		(0.04)	(0.10)	(0.22)	(0.33)	(0.45)	(0.60)
After-tax Profit		0.06	0.14	0.33	0.50	0.68	0.91
Worst-case Build-out Costs	(0.35)	(0.24)	(0.18)				
Cash Flow Stream	(0.35)	(0.18)	(0.04)	0.33	0.50	0.68	0.91
Industry Internal Rate of Return	40%						

(BIA/Kelsey, 2016)

This model also indicates that the total industry investment could be recouped in approximately three years from just the gain in advertising revenue and without consideration of datacasting or other business models.

It should be noted that while the conversion to ATSC 3.0 appears reasonable from an industry perspective, it does not mean it is so for all stations. BIA/Kelsey conducted an analysis of incremental advertising revenue for all full power television stations to determine how individual stations might consider this transition and its associated costs and benefits.

Based on this examination and the industry assumptions, BIA/Kelsey concluded that approximately three-quarters of commercial full power stations could recover the full $600,000 estimated build-out costs solely from the increase in advertising revenue and in a reasonable time frame (three to five years from time of investment). Additionally, with the exception of about 15% of the commercial full power stations, all other full power stations could justify the estimated $300,000 minimum build-out costs over a comparable time frame from the advertising revenue gain alone. The remainder, those with annual revenue of less than $2 million, will have a tougher time justifying the investment without consideration of other revenue sources or other factors.

Datacasting Revenue

There are no easy guidelines for estimating the revenue potentially generated from datacasting. It will be client specific based on the geography served, the

amount of spectrum provided and the client's application. To send encrypted content to specified receivers will require new hardware and software. The client will lease the bandwidth and will need to pay for the hardware and software required at the station, support and maintenance, and receivers.

Based on BIA/Kelsey's examination of an existing datacasting model, we concluded that the annual revenue potential for a station varies based on the size of its market and its population coverage. Despite a wide range in potential revenue, we believe that in the major markets incremental annual datacasting revenue could exceed $200,000 per Mbps once fully developed. The incremental datacasting revenue would fall off significantly as the population coverage declines from major markets to medium and then small markets. We believe this incremental revenue, however, would help a number of additional stations justify the investment.

Content Distribution and Edge Storage Revenue

This is a revenue source for which there is no current model involving the use of television bandwidth. A point of reference is Akamai and its business model utilizing cellular and internet for bandwidth distribution. According to its filings with the U.S. Securities and Exchange Commission, Akamai currently generates approximately $1.6 billion annually in the United States and $800 million globally from media delivery revenue.

Akamai is estimated to pay approximately $160 million in 2016 for bandwidth fees. We believe television stations will be able to garner a share of these bandwidth fees for use of a portion of their spectrum. For Akamai, this will be a cost reduction play, replacing some of its current bandwidth capacity with more efficient, lower cost television bandwidth. It is difficult to determine the potential revenue to broadcasters from this application with Akamai, but we estimate it could be in the tens of millions of dollars annually, presumably with the majority going to those stations with the largest population reach. And this is from just one customer. We believe a number of other companies could benefit from a similar service.

Home IoT Gateway and Other Revenue

While we can see the benefit of these applications, it is just too speculative to attempt to quantify. Similar to the cost savings for content delivery and storage,

we believe there is benefit to using television distribution for these and other applications, and it will be the product of negotiation and the geographic coverage provided. We also consider it in the best interest of television broadcasters to cooperate with other in-market and out-of-market stations to provide communications networks for a variety of applications.

CONCLUSIONS

ATSC 3.0 will change the business of broadcasting into a next generation wireless communications business. Broadcasters will pursue multiple new business models and significantly diversify their revenue mix.

Our analysis indicates that at an industry level, the benefits of the conversion to ATSC 3.0 far outweigh the associated costs. We estimate the net gains from increased advertising revenue alone will more than cover the investment cost in the first few years. Datacasting, content distribution and storage, and other business applications make the business case for this investment even more compelling.

Timing for the build-out for most stations is probably in the 2017 to 2019 timeframe. The incremental revenue could be generated soon thereafter for some major market stations and more in the 2020-plus range for others.

At a station level, the justifiability of the capital expenditure will vary significantly based on size of market, the station's population reach, and its current revenue and profitability. We believe three-quarters of the full power commercial stations in the United States will easily justify this investment.

While seeing benefit, the other stations may find it more difficult to recoup their investment in a reasonable time frame. Despite the difficulty in a pure financial justification for some stations, we believe all stations will make the conversion over the next three to five years, and consumers, advertisers and broadcasters will see the benefits of improved service.

ABOUT BIA/KELSEY

BIA/Kelsey analyzes, interprets and delivers original data, insights and analytics about the traditional and digital advertising and marketing marketplace. Over 30 years, we have developed an extensive proprietary body of data that we leverage to provide strategic recommendations our clients use to guide, organize and drive their business.

Key areas we focus on include:

- Advanced television
- Programmatic
- Local investment and activations
- Brand-to-local marketing and advertising
- Innovations in mobile, social and video
- Evolution in advertising and marketing
- Strategic sales

Around these coverage areas, we provide a range of customized strategic consulting and valuation services to address individual concerns. More details about both our strategic consulting (http://www.biakelsey.com/services/business-consulting/) and valuation services (http://www.biakelsey.com/services/valuations-appraisals/) can be found on our website.

Data in this report is found in several of our research products, including:

- 2017 U.S. Local Advertising Forecast
- Local Market Ad Reports
- Media Access Pro Database

You can also contact us info@biakelsey.com to discuss your particular business request.