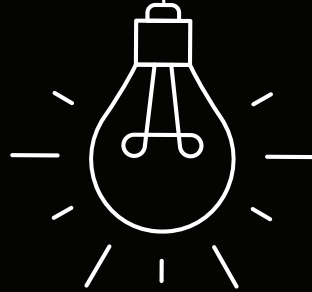


COWEN



COWEN RESEARCH
THEMES
2021

EDGE COMPUTING & 5G MOBILITY TECHNOLOGY ESG & ENERGY TRANSITION
ROBOTICS & AUTOMATION NEW PARADIGMS IN COMPUTING
CONSUMER TRANSFORMATION CANNABIS LIQUID BIOPSY
TARGETED THERAPIES CENTRAL NERVOUS SYSTEM ELECTION 2020
U.S. / CHINA COMPETITION & DECOUPLING BIG TECH & GOVERNMENT
EQUITY & FAIRNESS

**FROM COWEN DIRECTOR OF RESEARCH
ROBERT FAGIN**

COVID-19 forced a year of “creative destruction,” wherein businesses rushed to challenge conventional models and adapt to new norms. In many cases, such as with e-commerce and telehealth, a multi-year march toward adoption was dramatically accelerated by a stay-at-home and work-from-home environment.

Simultaneously, a politically and socially charged atmosphere, including a contentious U.S. election and deepening geopolitical rifts such as United States-China relations, further increased market tension and uncertainty.

Remarkably, despite this backdrop of general unease and disorder, extraordinary innovation persisted in areas as diverse as targeted medical therapies, edge computing, 5G, robotics and automation, electrified transportation, and the adoption of clean energy.

In this Handbook, we once again feature themes where Cowen’s domain expertise has been central to the discussion and debate. In nearly all cases, Cowen Research offered its hallmark collaborative approach to help inform our viewpoints, working across sector teams to provide valuable perspective, and incorporating the views of our Washington Research Group in a rapidly shifting political environment. Each theme highlighted is accompanied by a listing of relevant Cowen reports and events, which we hope supports deeper engagement on these pivotal issues.

As the haze of the recent U.S. election and COVID-19 lifts, we will continue to keep a sharp focus on our Ahead Of The Curve® mission of Outperformance, looking through a wide lens to develop a comprehensive view of the key themes we expect to drive investment gains and losses in 2021 and beyond.

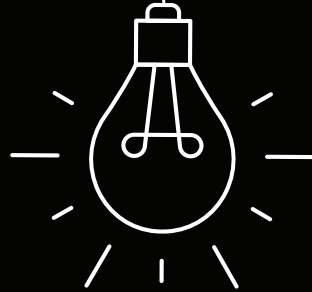
We hope this work is helpful to you in the year ahead.

Sincerely,



Robert Fagin
Director of Research
Cowen

Special thanks to Bill Bird and Dan Terlizzi for preparing this handbook, and to Michelle Becker and Diana Harris-Stewart for its design and layout.



COWEN RESEARCH **THEMES 2021** LINK DIRECTORY

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U.S. / CHINA COMPETITION & DECOUPLING PAGE 76 |  

BIG TECH & GOVERNMENT PAGE 82 |  

EQUITY & FAIRNESS PAGE 88 |  

EDGE COMPUTING & 5G

Edge computing represents the next wave of compute, storage, and networking infrastructure modernization. Edge computing is defined as the trend of moving processing closer to where data is being generated. Many market participants were quick to dismiss the potential of the cloud, and while edge computing faces similar skepticism, our team's perspective is that edge will see similar exponential growth to cloud computing.

 **WATCH VIDEO** MATTHEW D. RAMSAY



 **WHAT WE'RE WATCHING**

- Micro data center investment
- AI market development
- Edge accelerator growth
- New use cases
- Ecosystem partnerships

 **RELATED THEMES**

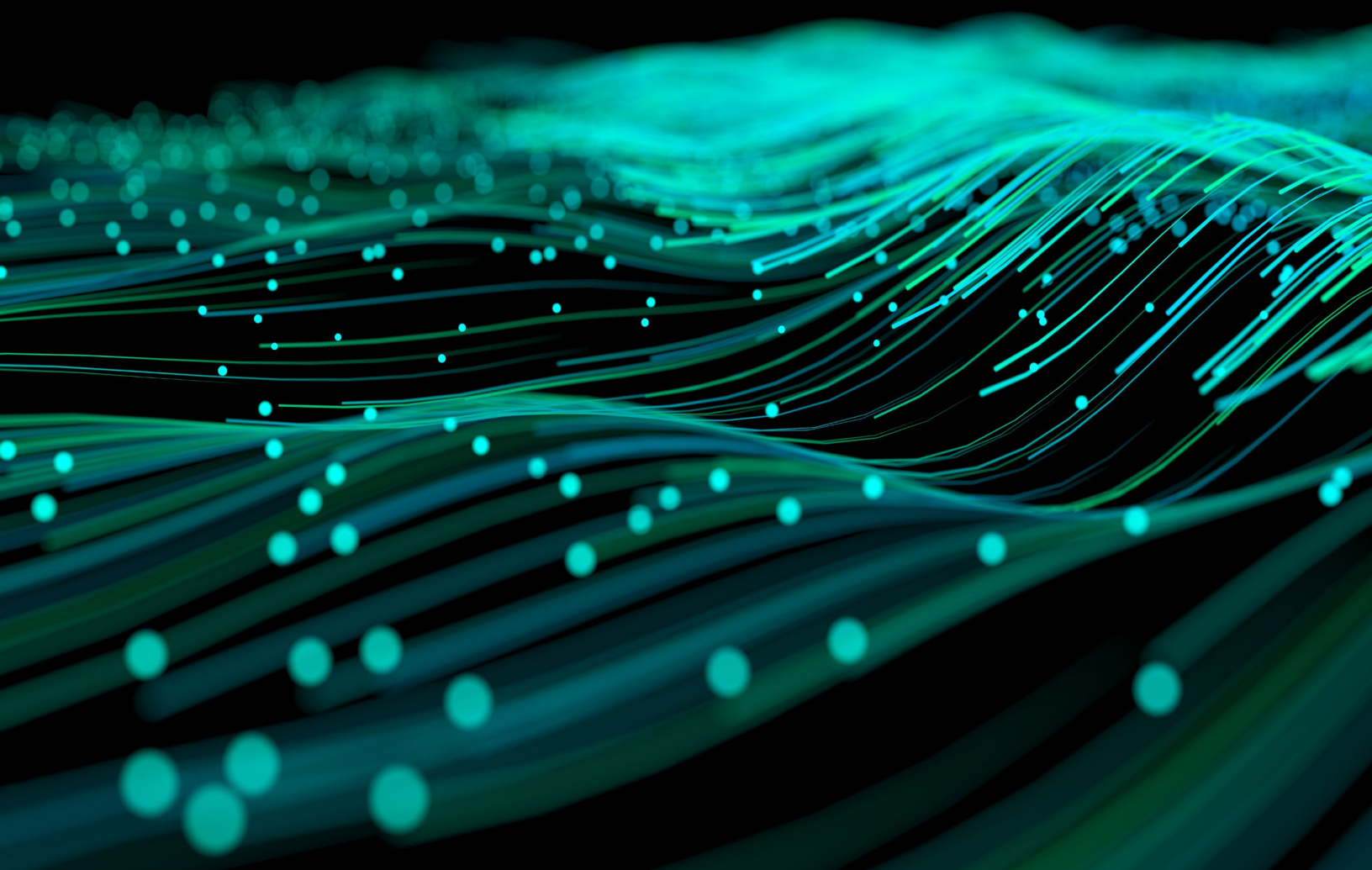
- Mobility technology
- Robotics & automation
- Big tech & government
- Consumer transformation
- ESG / energy transition
- New paradigms In computing



“Edge Computing’s initial forecasts draw many parallels to the early days of the cloud when investors were very skeptical. Today, cloud computing is 40% of the server market and we see edge computing following a similar, potentially exponential, adoption curve and crossing the \$100B threshold in the coming decade.”

— **AHEAD OF THE CURVE® SERIES**

Livin’ on the Edge



10%

OF CLOUD SERVERS TO BE
DEPLOYED IN EDGE
LOCATIONS IN EIGHT YEARS

“Whereas today’s Internet has largely been built for humans, this new Internet will be built for machines.”

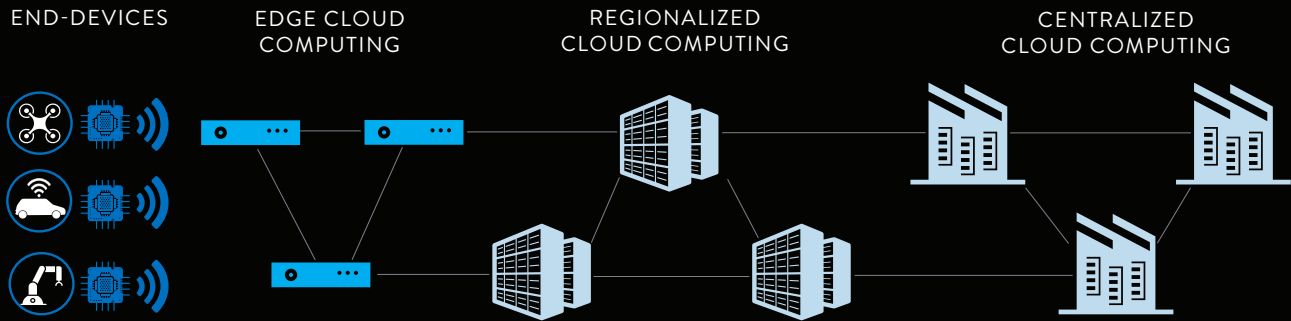
— **AHEAD OF THE CURVE® SERIES**

Livin’ on the Edge



Edge Computing, Defined As The Trend Of Moving Processing Closer To Where Data Is Being Generated, Will Be Critical To The Operation Of Present And Future Technologies

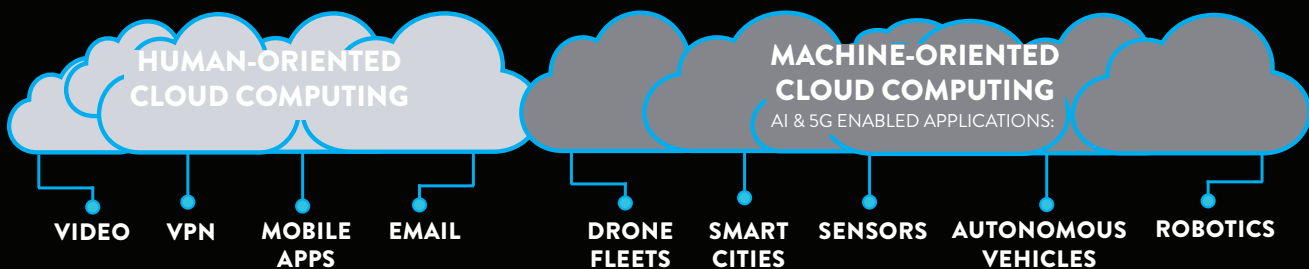
EDGE COMPUTING ARCHITECTURE



Source: Cowen and Company

As Autonomous Machines (Versus People And Businesses) Become The Dominant Cloud Users, Demand For Real-Time Data And AI-Accelerated Computing Will Be Pulled To The Edge

HUMAN VS. MACHINE-ORIENTED COMPUTING



Human-oriented applications generally do not require low-latency computation and therefore will continue to utilize centralized computing and 4G/5G networks.

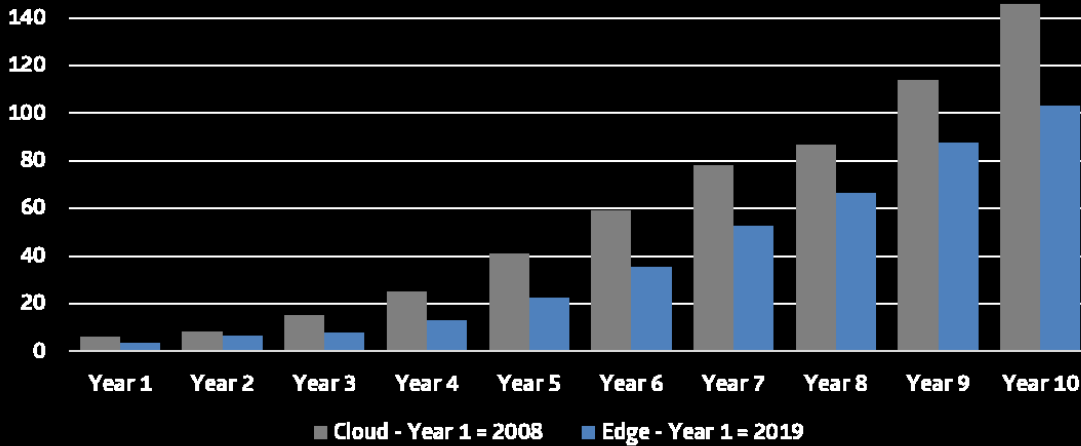
Machine-oriented applications are latency-sensitive, and will require Edge Infrastructure. These industrialized use cases will create novel demand and be major growth drivers for every industry across the world.

Source: Cowen and Company



Though Edge Computing Is In The Early Stages, We See Cloud-Like Growth Potential

PUBLIC CLOUD COMPUTING VS. EDGE COMPUTING 10-YEAR COMPARISON, \$ IN BILLIONS



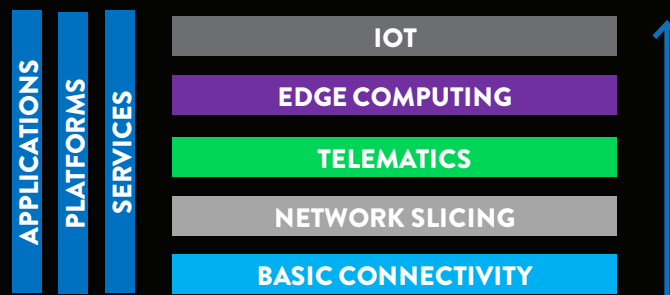
EDGE ADOPTION DRIVERS

- Data explosion.
- Hyperscale, public cloud have put computing power, data storage, and software developers under one roof.
- GPU’s application to AI.
- Enterprise spending on AI is increasing. Machines will become the new cloud computing end users.
- Software – improvements in virtualization, networking, and AI innovation across the stack.

Source: Cowen and Company, Statista, Tolaga Research

The Advent Of 5G Offers Carriers An Opportunity To Pursue New Business Models Beyond The Phone That Will Leverage Wireless Networks

NEW OPPORTUNITIES TO PLAY “UP THE STACK”

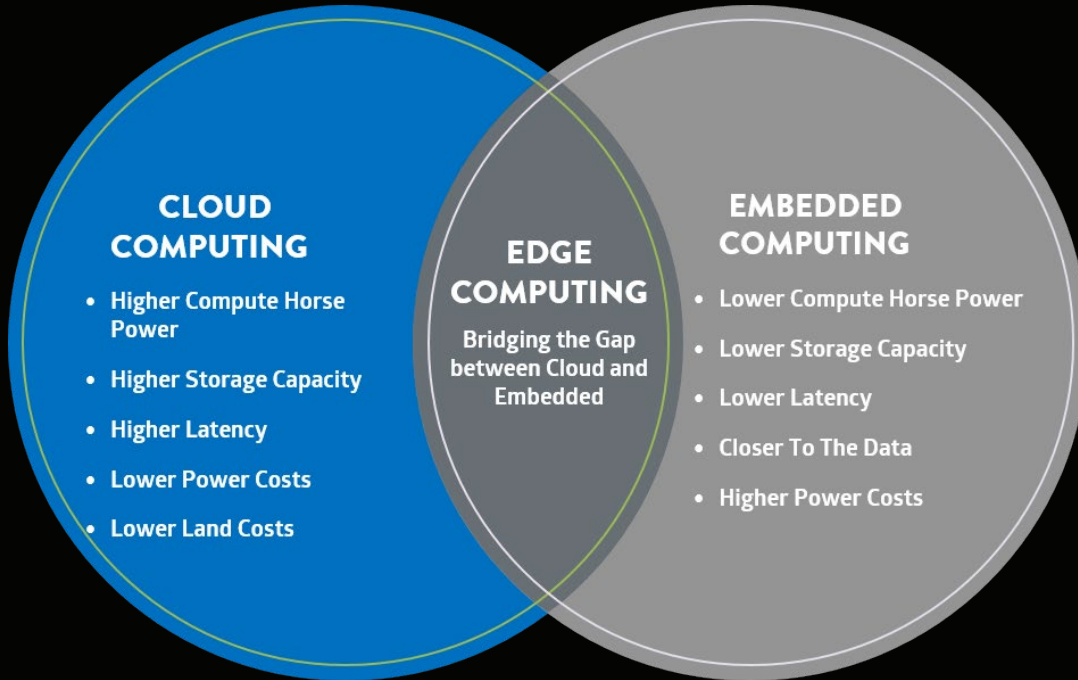


Source: Cowen and Company



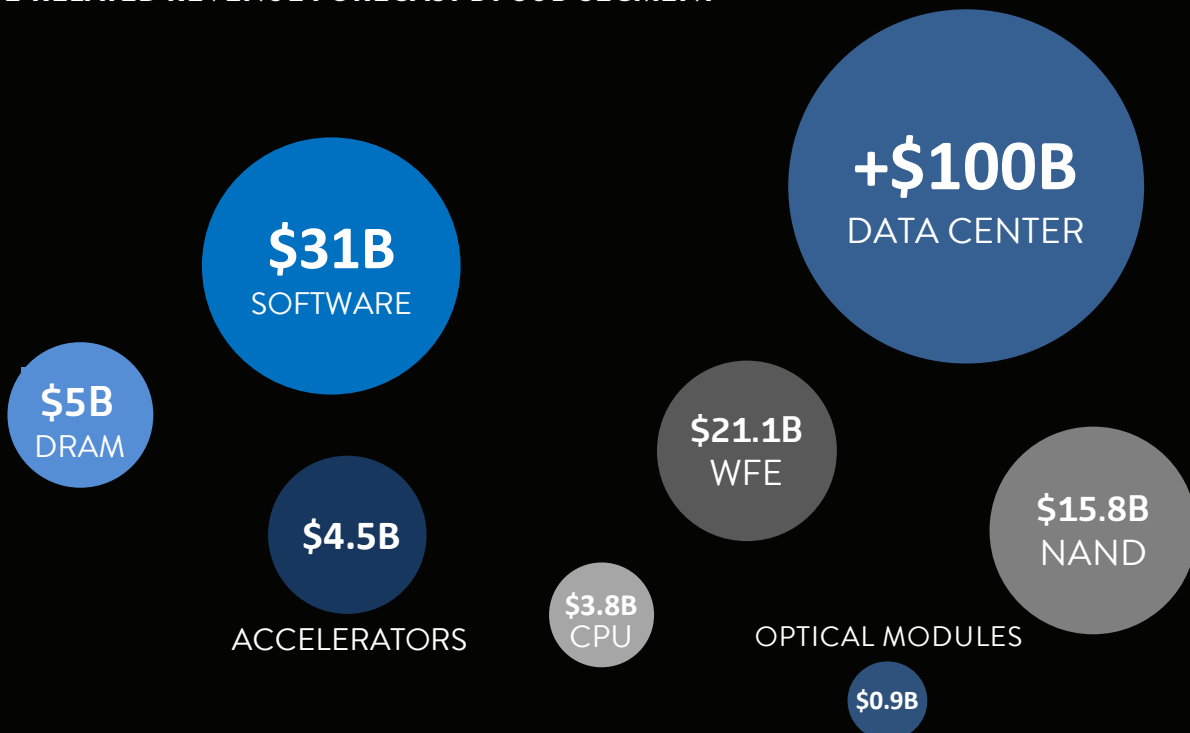
Edge Will Bring Together The Best Of Cloud And Embedded Computing With Faster Time-To-Insight, Critical To AI

KEY COMPUTING ATTRIBUTES



Source: Cowen and Company

2028 EDGE-RELATED REVENUE FORECAST BY SUB-SEGMENT



Source: Cowen and Company



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CHRIS KRUEGER
ROMAN SCHWEIZER

REPRESENTATIVE RESEARCH

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LIVIN' ON THE EDGE PART 5: ENABLING & EMPOWERING LOCALLY

May 22, 2020

Cowen Analysts: Listed above

AHEAD OF THE CURVE® SERIES

LIVIN' ON THE EDGE PART 4: SOFTWARE & SECURITY

May 21, 2020

Cowen Analysts: Listed above

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LIVIN' ON THE EDGE PART 3: STORAGE & NETWORKING

May 20, 2020

Cowen Analysts: Listed above

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LIVIN' ON THE EDGE PART 2: COMPUTE & MEMORY AT THE EDGE

May 19, 2020

Cowen Analysts: Listed above

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LIVIN' ON THE EDGE PART 1: EVOLVING TOMORROW'S INTERNET

May 18, 2020

Cowen Analysts: Listed above

VERIZON: TAKEAWAYS FROM VIRTUAL MEETINGS; STAYING THE COURSE TOWARD "TRUE" 5G

June 12, 2020

Cowen Analysts: Colby Synesael, Gregory Williams, CFA

TAKEAWAYS FROM EDGE PANEL; THE NEXT STEP IN THE EVOLUTION OF COMPUTE

May 29, 2020

Cowen Analysts: Colby Synesael, Gregory Williams, CFA

COWEN COMPANY COVERAGE

ACACIA COMMUNICATIONS **ACIA**
 ADVANCED MICRO DEVICES **AMD**
 AKAMAI **AKAM**
 ALPHABET **GOOG**
 ALTICE **ATUS**
 AMAZON.COM **AMZN**
 AMBARELLA **AMBA**
 AMERICAN TOWER **AMT**
 APPLE **APPL**
 ARISTA NETWORKS **ANET**
 AT&T **T**
 BLOOM ENERGY **BE**
 BROADCOM **AVGO**
 CENTURYLINK **CTL**
 CEVA **CEVA**
 CIENA CORP **CIEN**
 CISCO SYSTEMS **CSCO**
 COGENT **CCOI**
 CORESITE **COR**
 CROWN CASTLE **CCI**
 CYRUSONE **CONE**
 DIGITAL REALTY **DLR**
 DISH NETWORK **DISH**
 EQUINIX **EQIX**
 GDS HOLDINGS **GDS**
 GTT COMMUNICATIONS **GTT**
 II-VI **IIVI**
 INPHI CORPORATION **IPHI**

INTEL **INTC**
 JUNIPER NETWORKS **JNPR**
 LATTICE SEMICONDUCTOR **LSCC**
 LIMELIGHT NETWORKS **LLNW**
 MACOM TECHNOLOGY SOLUTIONS **MTSI**
 MARVELL **MRVL**
 MICROCHIP TECHNOLOGY **MCHP**
 MICRON **MU**
 MICROSOFT **MSFT**
 NETAPP **NTAP**
 NEOPHOTONICS **NPTN**
 NVIDIA **NVDA**
 NXP SEMICONDUCTOR **NXPI**
 PURE STORAGE **PSTG**
 QUALCOMM **QCOM**
 QTS REALTY TRUST **QTS**
 SEAGATE TECHNOLOGY **STX**
 SBA COMMUNICATIONS **SBAC**
 SILICON LABS **SLAB**
 STMICROELECTRONICS **STM**
 SYNAPTICS **SYNA**
 SWITCH **SWCH**
 UNITI GROUP **UNIT**
 VERIZON COMMUNICATIONS **VZ**
 WESTERN DIGITAL **WDC**
 XILINX **XLNX**

SELECTED EVENTS

2020 SEMICONDUCTOR BUS TOUR

November 17-20, 2020

2020 SOFTWARE BUS TOUR

November 9, 2020

2020 NETWORKING BUS TOUR

August 18-19, 2020

2020 COMMUNICATIONS INFRASTRUCTURE SUMMIT

August 11-12, 2020

INTERNET BUS TOUR

August 10-14, 2020

INDUSTRIAL TECHNOLOGY, ROBOTICS & SUSTAINABILITY SUMMIT

June 1-3, 2020

2020 TECHNOLOGY, MEDIA & TELECOM CONFERENCE

May 26-29, 2020

MOBILITY TECHNOLOGY

The \$7 trillion transportation industry is ripe for transformation given technological advancements in batteries, sensing equipment, vehicle light-weighting, silicon carbide efficiency gains, connectivity, and processing power that are enabling electrified and autonomous vehicles in the future. We see the pace of vehicle electrification proceeding faster than many investors expect. We see 2022-2025 as the period when the proverbial “hockey stick” of demand begins to accelerate.

 [WATCH VIDEO](#) JEFFREY OSBORNE



WHAT WE'RE WATCHING

- Declines in renewable energy costs
- Improvements in battery density
- OEM investments
- Partnerships

RELATED THEMES

- Edge computing
- New paradigms in computing
- Robotics & automation
- ESG / energy transition



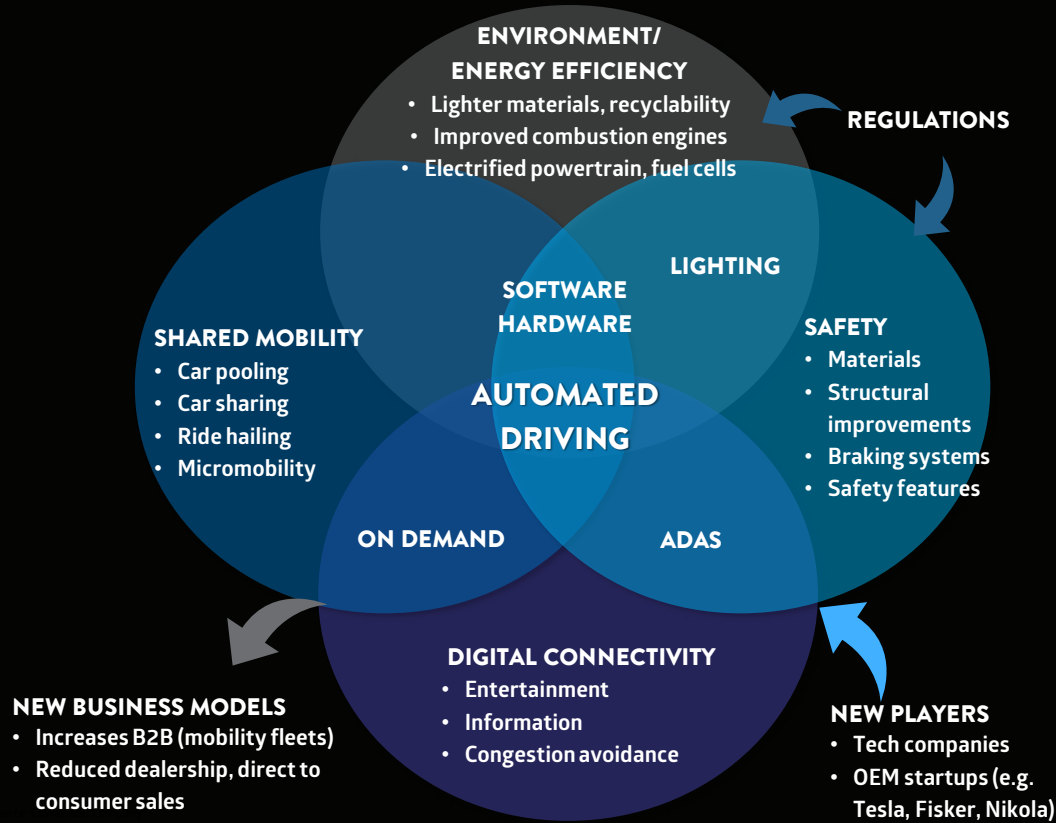
“We see the pace of vehicle electrification proceeding faster than many investors expect. We see a great deal of change in the early 2020s for the Mobility industry, leveraging technology to shift to a safe, green and connected ecosystem.”

— **AHEAD OF THE CURVE® SERIES**
Future of Mobility Primer





Several Trends Are Transforming The Mobility Industry

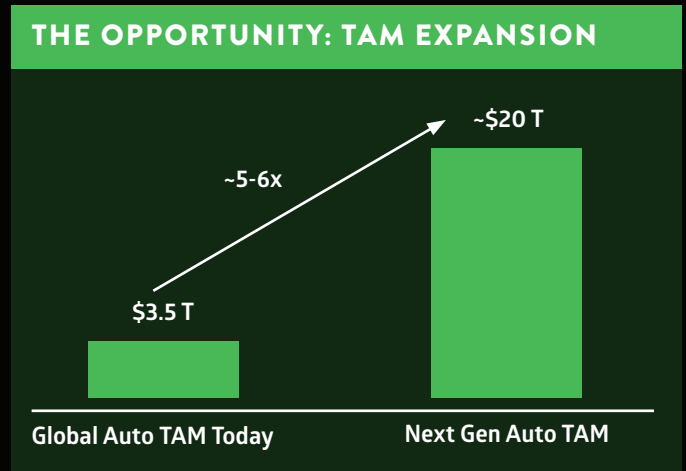


Source: Cowen and Company

The Global Auto Industry Faces Four Concurrent Threats; The Winners Will Tap Into A Bigger Revenue Pool

AUTOMOBILE INDUSTRY THREATS

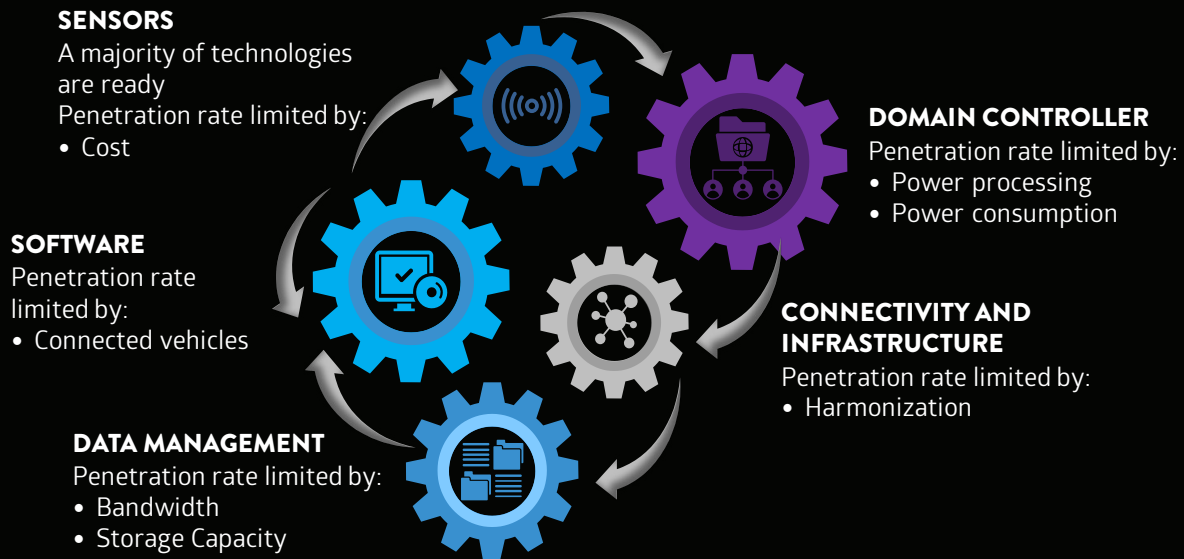
- **CONNECTED CAR**
- **ELECTRIC VEHICLE**
- **AUTONOMOUS DRIVING TECHNOLOGY**
- **TRANSPORTATION-AS-A-SERVICE**



Source: Cowen and Company



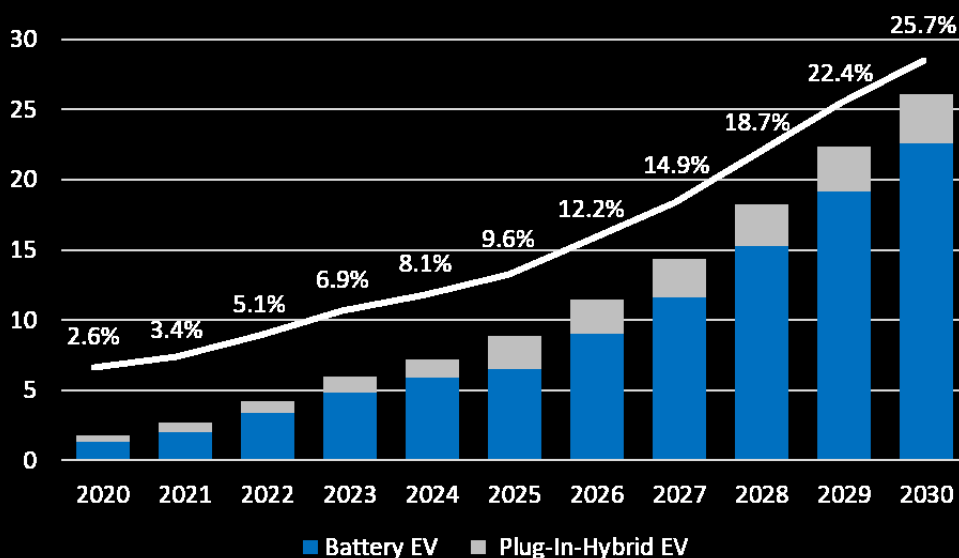
Mobility Disruption Is Upon Us. OEMs Will Need Auto 2.0 Technology Building Blocks For Automation In Future Vehicles



Source: Cowen and Company

We See The First Disruption In The Industry Coming From EVs: 2.6% Of Global Sales Today Growing 10X To 25.7% in 2030

GLOBAL ELECTRIC LIGHT VEHICLE SALES, ESTIMATED NUMBER OF VEHICLES IN MILLIONS, % OF MARKET ELECTRIC



Source: Cowen and Company, IHS Global Production Forecast



We See A Tipping Point In Price Parity Between EVs And ICE Vehicles In The 2022-2030 Time Frame

YEAR OF EXPECTED PRICE PARITY

Segment	US	Europe	China	Japan	South Korea
Small	2024	2027	2026	>2020	2026
Medium	2024	2023	2023	2029	2024
Large	2022	2022	2027	2027	2026
SUV	2022	2024	2029	2025	2023

Source: Bloomberg New Energy Finance, Cowen and Company

Applying A Broader Lens, Autonomous Vehicles Could Disrupt Many Parts Of The Economy

<p>TRANSPORTATION</p> <p>Substitution of demand for taxis, black cars, rental cars with shared fleets.</p>	<p>FINANCE</p> <p>Growth in fleet financing in place of auto loans and leasing.</p>	<p>INSURANCE</p> <p>Shifts from personal liability to catastrophic systems-failure coverage.</p>	<p>MEDIA</p> <p>In-vehicle multimedia consumption to grow. No more outdoor billboards?</p>
<p>MEDICAL</p> <p>Reduced need for emergency medical services and EMTs.</p>	<p>PUBLIC SECTOR</p> <p>Erosion of tax revenue related to property and fuel taxes, vehicle registrations, tickets.</p>	<p>RETAIL</p> <p>Increase in sales due to increased mobility and time.</p>	<p>TELECOM</p> <p>Enhanced bandwidth requirements to meet increased demand for connectivity.</p>
<p>TECHNOLOGY</p> <p>Emergence of autonomous drive operating system companies.</p>	<p>MASS TRANSIT</p> <p>Last mile service, bus replacement, bus augmentation, new forms of mass transit, other?</p>	<p>REAL ESTATE</p> <p>Parking garages devalued and repurposed.</p>	<p>ENERGY</p> <p>Lower energy consumption from improved vehicle efficiency. What happens to gas stations?</p>
<p>GOODS DELIVERY</p> <p>Expedites delivery of groceries, packages, courier services, restaurant take-out.</p>	<p>RIDE HAILING</p> <p>Uber, Didi, Lyft, Auto OEMs</p>	<p>CAR OWNERSHIP</p> <p>Fewer cars per household.</p>	

Source: Cowen and Company



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REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES

COVID RECOVERY: A TALE OF TWO CITIES

November 18, 2020

Cowen Analysts: Cai von Rumohr, CFA, Gautam Khanna, Helane Becker

AHEAD OF THE CURVE® SERIES

FUTURE OF MOBILITY PRIMER

September 8, 2020

Cowen Analysts: Jeffrey Osborne, Matthew D. Ramsay, Karl Ackerman, CFA, Joseph Giordano, CFA, Paul Silverstein, John Blackledge, Colby Synesael, J. Derrick Wood, CFA, George Mihalos, Jason H. Seidl, Matt Elkott, Helane Becker, Tyler Kenyon, Andrew M. Charles, CFA, Jason Gabelman, Chris Krueger

AHEAD OF THE CURVE® SERIES

LIVIN' ON THE EDGE, PART 5: ENABLING & EMPOWERING LOCALLY

May 22, 2020

Cowen Analysts: Joseph Giordano, CFA, Jeffrey Osborne, Krish Sankar, Bryan C. Bergin, CFA, Doug Creutz, CFA, Karl Ackerman, CFA, John Blackledge, Matthew Ramsay, Paul Silverstein, Colby Synesael, Gregory Williams, CFA, J. Derrick Wood, CFA, Nick Yako

PANDEMIC-DRIVEN FLEET RESTRUCTURING TO ACCELERATE FUEL EFFICIENCY GAINS: PART 2

August 27, 2020

Cowen Analyst: Helane Becker

NIKOLA INITIATION: MORE THAN JUST A TRUCK COMPANY; OUTPERFORM AND \$79 PRICE TARGET

June 17, 2020

Cowen Analyst: Jeffrey Osborne

SURVEY: UBER RIDESHARING IN US & UK; FOOD DELIVERY PENETRATION: US, UK, DE & JP

March 12, 2020

Cowen Analyst: John Blackledge

COWEN COMPANY COVERAGE

ALPHABET **GOOG**
 AMAZON.COM **AMZN**
 AMBARELLA **AMBA**
 AMERICAN AIRLINES **AAL**
 AMPHENOL **APH**
 AMTECH SYSTEMS **ASYS**
 APTIV **APTIV**
 AT&T **T**
 BALLARD POWER SYSTEMS **BLDP**
 BORGWARNER **BWA**
 BP PLC **BP**
 CANADIAN NATIONAL RAILWAY **CNI**
 CERENCE **CRNC**
 CREE **CREE**
 COGNEX **CGNX**
 C.H. ROBINSON WORLDWIDE **CHRW**
 CSX CORP. **CSX**
 CUMMINS **CFI**
 DELTA AIR LINES **DAL**
 DOMINO'S PIZZA **DPZ**
 FEDEX CORP. **FDX**
 FLEETCOR TECHNOLOGIES **FLT**
 GRUBHUB **GRUB**
 II-VI **IIVI**
 INFINEON **IFX.GR**
 INTEL **INTC**
 J.B. HUNT TRANSPORT SERVICES **JBHT**
 JETBLUE AIRWAYS **JBL**
 LEAR **LEA**
 LITTELFUSE **LFUS**
 LYFT **LYFT**
 MASTERCARD **MA**
 MELEXIS **MELE.BB**
 NIKOLA **NKLA**
 NVIDIA **NVDA**
 NXP SEMICONDUCTORS **NXPI**
 OLD DOMINION FREIGHT LINE **ODFL**
 ON SEMICONDUCTOR **ON**
 PACCAR **PCAR**
 PLUG POWER **PLUG**
 PAYPAL **PYPL**
 POWER INTEGRATIONS **POWI**
 QUALCOM **QCOM**
 ROYAL DUTCH SHELL **RDSA/A**
 SENSATA TECHNOLOGIES **ST**
 SOUTHWEST AIRLINES **LUV**
 SPIRIT AIRLINES **SAVE**
 STMICROELECTRONICS **STM**
 TE CONNECTIVITY **TEL**
 TESLA INC. **TSLA**
 TOTAL SA **TOT**
 UBER TECHNOLOGIES **UBER**
 UNION PACIFIC CORP. **UNP**
 UNITED AIRLINES HOLDINGS **UAL**
 UNITED PARCEL SERVICE **UPS**
 VEONEER **VNE**
 VERIZON **VZ**
 VIRGIN GALACTIC HOLDINGS **SPCE**
 VISA **V**
 VISTEON **VC**
 WABTEC CORP. **WAB**
 WESTPORT FUEL SYSTEMS **WPRT**
 WORKHORSE GROUP **WKHS**
 XPO LOGISTICS **XPO**

SELECTED EVENTS

2ND ANNUAL PRIVATE COMPANY SUMMIT

October 21-22, 2020

GLOBAL TRANSPORTATION & SUSTAINABLE MOBILITY CONFERENCE

September 9-11, 2020

2020 INTERNET BUS TOUR

August 10-14, 2020

INDUSTRIAL TECHNOLOGY, ROBOTICS & SUSTAINABILITY CONFERENCE

June 1-3, 2020

ESG & ENERGY TRANSITION

Socially conscious investing, well underway pre-COVID, has gained momentum. COVID's destructive aftermath, and continued focus on climate change, lead more investors to take into consideration stakeholder capitalism and the bigger picture. Consistent with this theme, institutional investors are shifting their portfolios away from carbon-intensive assets toward renewables. Renewables are now becoming cost competitive with hydrocarbon fuels and we believe a number of clean tech companies are positioned to benefit.

 **WATCH VIDEO** JEFFREY OSBORNE



WHAT WE'RE WATCHING

- EV cost parity
- Traditional oil & gas company moves into sustainable energy assets
- U.S. emissions policy and Paris Agreement
- Hydrogen technology

RELATED THEMES

- Mobility technology
- Robotics & automation
- Consumer transformation



“We see the world on the cusp of a resource revolution. Advancement in information technology, materials science, and biology will radically increase the productivity of resources. As the global economy improves, we are seeing a greater consensus on the need for more environmentally conscious growth.”

— **AHEAD OF THE CURVE® SERIES**
Sustainable Energy & Industrial Technology Primer



76%

OF SURVEY RESPONDENTS AGE 18-34 INDICATE THAT SOCIAL RESPONSIBILITY AND SUSTAINABILITY ARE AN IMPORTANT PART OF PURCHASE DECISIONS

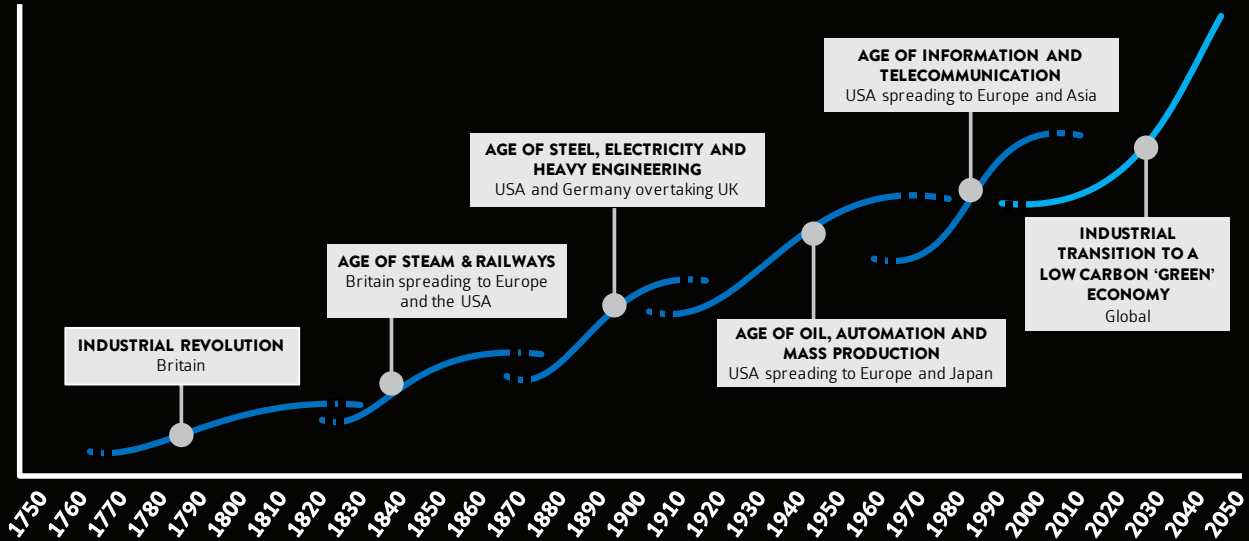
\$3.5T

PER YEAR IN RENEWABLE ENERGY INVESTMENTS REQUIRED, ON AVERAGE, BETWEEN NOW AND 2050 TO LIMIT GLOBAL TEMPERATURE RISE



We Are At A Tipping Point In The Transition To A Low-Carbon Economy

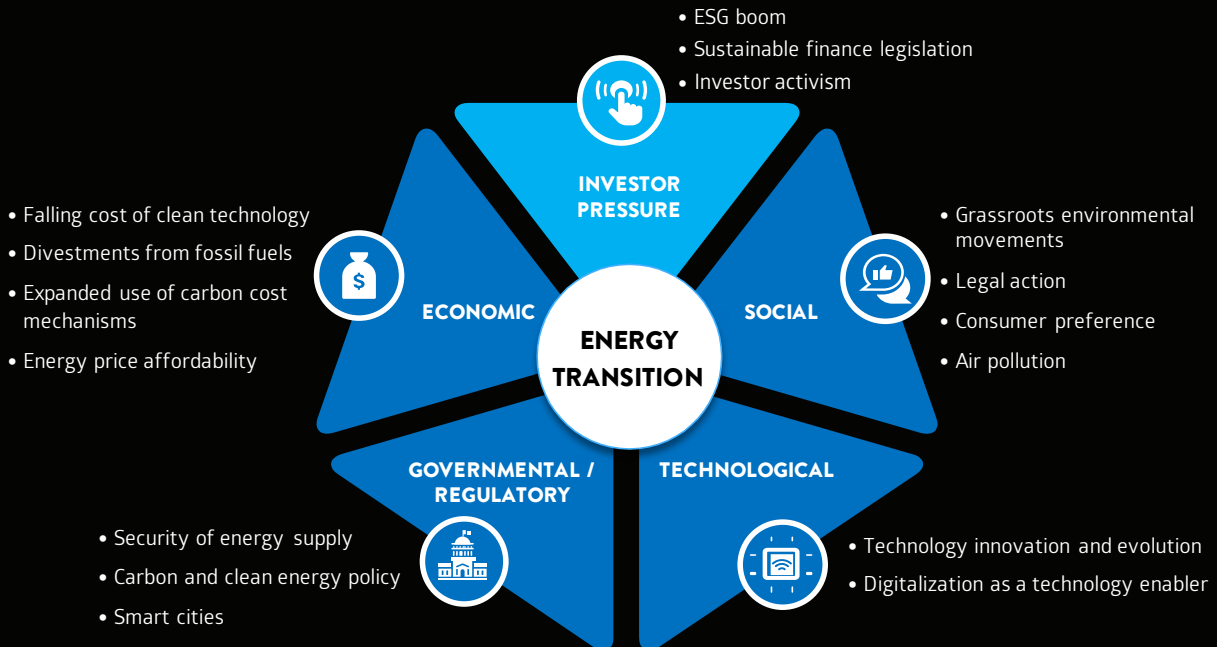
DEGREE OF TECHNOLOGICAL MATURITY AND MARKET SATURATION



Source: Cowen and Company; Derived from: Technological Revolutions and Financial Capital

Several Factors Are Accelerating The Energy Transition

KEY FACTORS ACCELERATING THE DE-CARBONIZED ENERGY TRANSITION

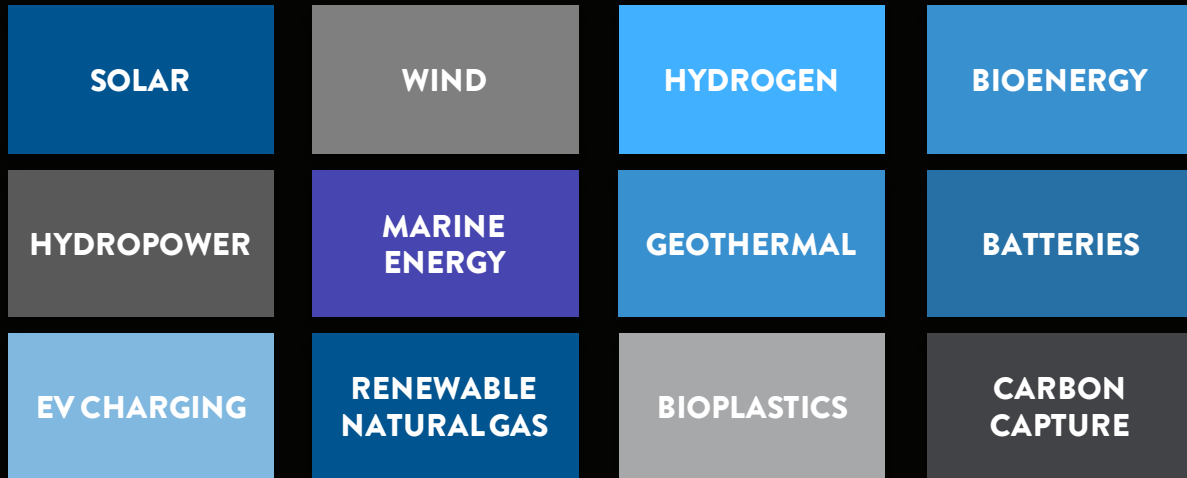


Source: Cowen and Company



No Single Silver Bullet Will Solve The World's Energy Crisis. We See Room For Multiple Technologies To Succeed.

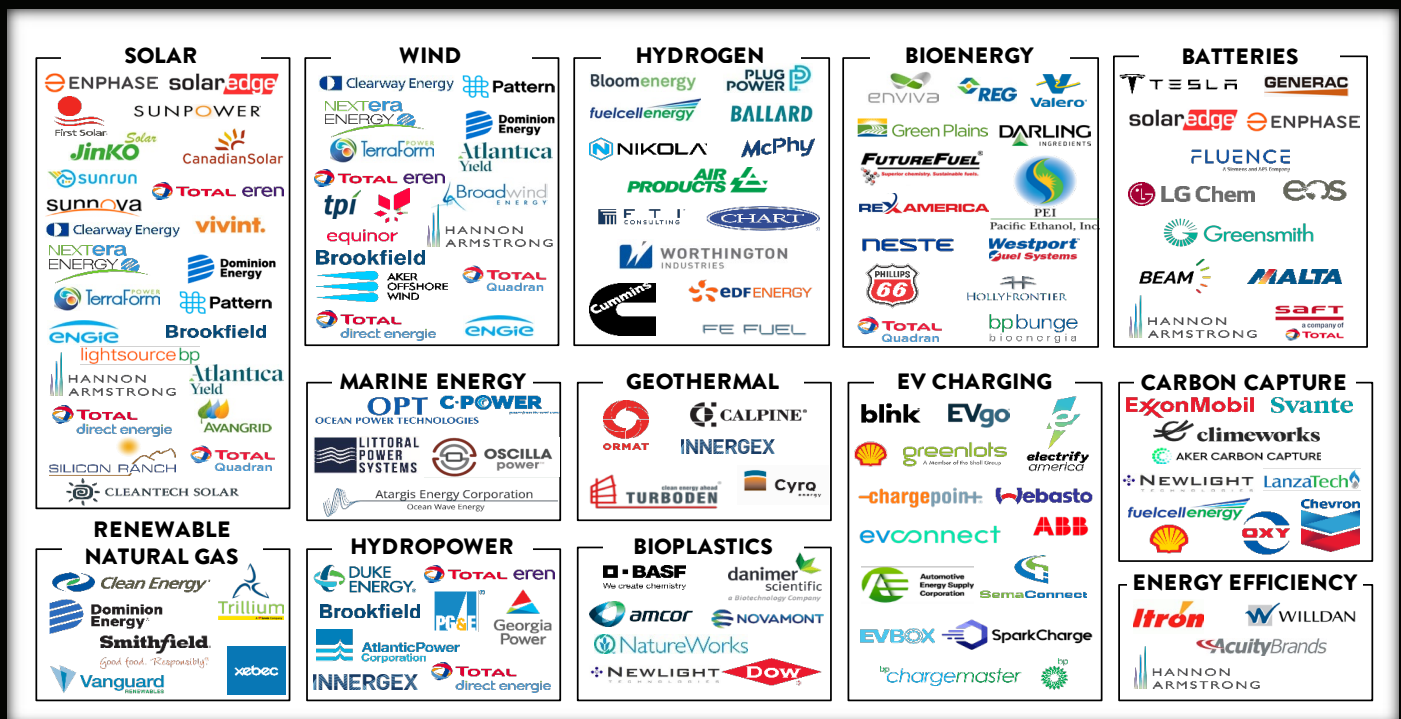
ENERGY TRANSITION SOLUTIONS



Source: Cowen and Company

Many Will Compete In Energy Transition's Growth Vectors, Which Will Attract Decarbonizing Incumbents And Clean-Tech Innovators

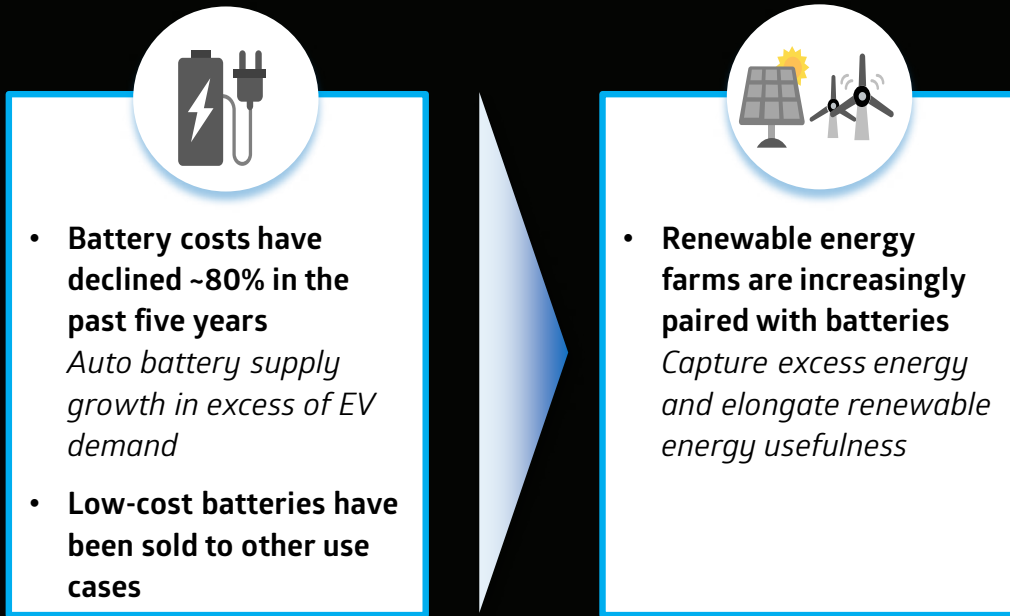
COWEN ENERGY TRANSITION COMPETITIVE LANDSCAPE



Source: Cowen and Company



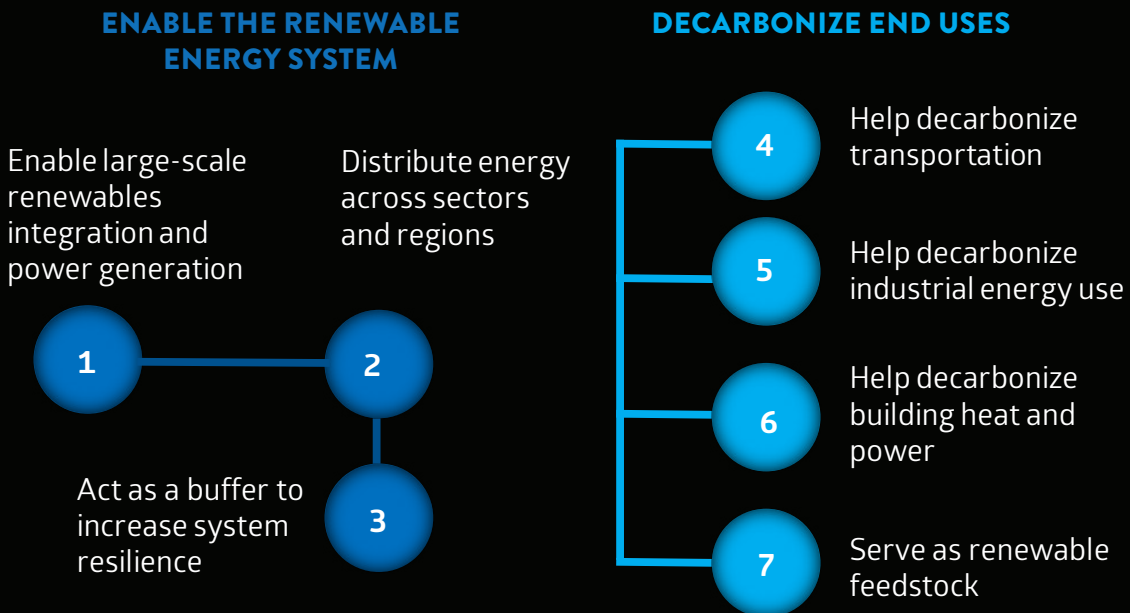
Batteries Are No Longer Just A Form Of Storage For Cars



Source: Cowen and Company

The Hydrogen Revolution Is Nascent With Significant Growth Potential

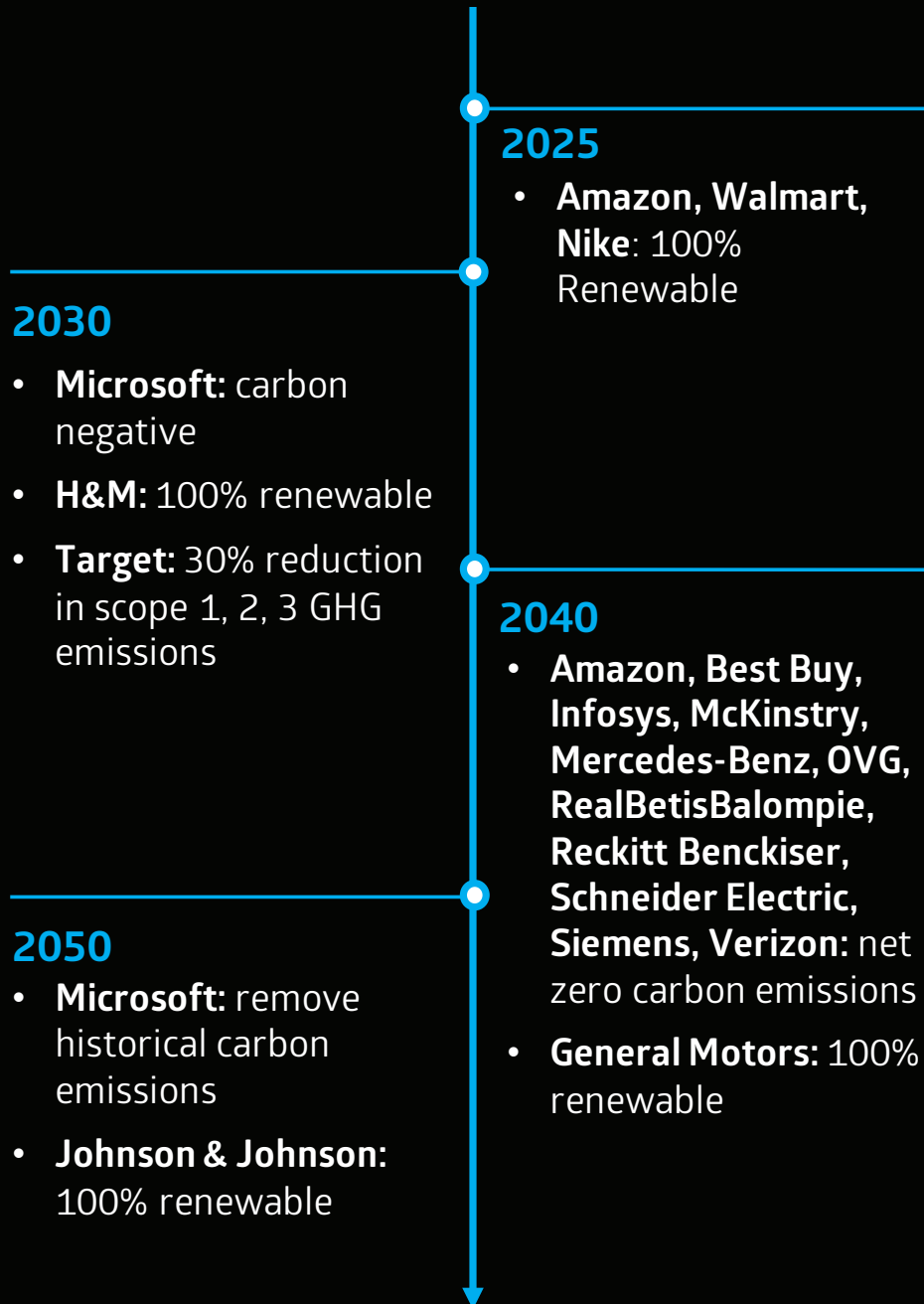
HYDROGEN'S POTENTIAL ROLES IN ENERGY TRANSITION



Source: Cowen and Company



Companies Are Responding, Setting More Aggressive Targets To Reduce Carbon Emissions



Source: Cowen and Company, Company reports

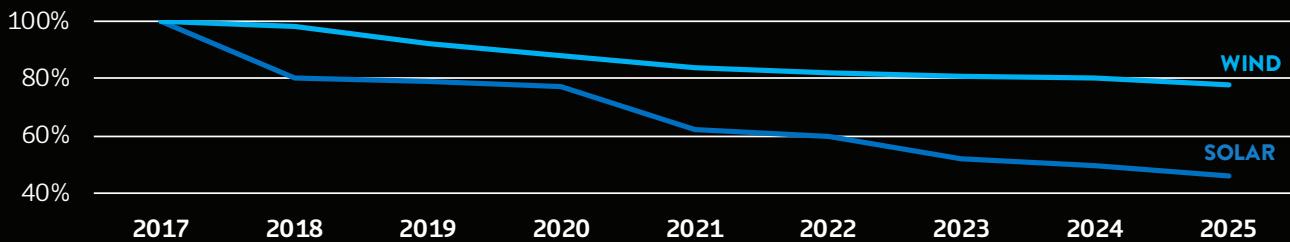


As Renewable Energy Production Ramps, Costs Will Decline

SOLAR AND WIND CAPACITY, NORTH AMERICA, GW

	2018	2030	2050	UNDER CONSTRUCTION	PERMITTED
Onshore Wind	107	330	1,146	20	29
Offshore Wind	0	23	164	-	-
Solar PV	55	437	1,728	24	22

SOLAR AND WIND COSTS, INDEXED TO 2017



Source: Cowen and Company, IRENA, BNEF

We See A Big Potential Universe Ripe For Disruption

	FOSSIL FUEL	ENERGY TRANSITION SEGMENTS				DECARBONIZATION
MARKETS						
Transportation	Vehicle Installed PV EV Charging Station	Plug-in Hybrid EVs, Zero-Emission Vehicles, Autonomous EVs Biofuels, Hydrogen, Batteries, Fuel Cells				
Services	Retail	Demand Response, Net Metering Distribution, Generation Renewable Power Providers				
Efficiency Infrastructure		Intelligent Network Devices Solid State Lighting Intelligent Sensors Advanced Components Energy IT Smart Grid Mgmt.				High Voltage D.C. Transmission
Power Generation	Nanopower	Solar PV Wind Ocean, Geothermal				Biomass, Nuclear, Clean Coal
Energy Storage	Integrated Mini Fuel Cell, Direct Liquid Fuel Cell	Supercapacitors, Superconducting Magnetic Energy Storage Fuel Cells				Flow Batteries, Flywheel, Compressed Air
Materials		Biopolymers Cement, Drywall, And Other Building Materials Molecular Nanotechnology, Chemicals & Solvents				
Recycling & Waste				Technology Recycling	Bio - And Phytoremediation Waste To Energy	
Water	Domestic Gray Water Recycling	Water Purification		Industrial Gray Water Recycling	Water Management	
	PERSONAL	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	GOVERNMENT	UTILITY

Source: Cowen and Company



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JASON H. SEIDL
MATT ELKOTT
MATTHEW D. RAMSAY
KRISH SANKAR
KARL ACKERMAN, CFA

REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES

COUNTING CARBON: NAVIGATING THE ENERGY TRANSITION

October 26, 2020

Cowen Analysts: Jason Gabelman, David Deckelbaum, CFA, Marc Bianchi, CFA, Gabe Daoud, Jr., Jeffrey Osborne

AHEAD OF THE CURVE® SERIES

FUTURE OF MOBILITY PRIMER

September 8, 2020

Cowen Analysts: Jeffrey Osborne, Matthew D. Ramsay, Karl Ackerman, CFA, Joseph Giordano, CFA, Paul Silverstein, John Blackledge, Colby Synesael, J. Derrick Wood, CFA, George Mihalos, Jason H. Seidl, Matt Elkott, Helane Becker, Tyler Kenyon, Andrew M. Charles, CFA, Jason Gabelman, Chris Krueger

AHEAD OF THE CURVE® SERIES

SUSTAINABLE ENERGY & INDUSTRIAL TECHNOLOGY PRIMER

June 1, 2020

Cowen Analyst: Jeffrey Osborne, Joseph Giordano, CFA

AHEAD OF THE CURVE® SERIES

GEN Z/MILLENNIALS: SUSTAINABILITY SUPPORTS DURABILITY

June 1, 2020

Cowen Analysts: John Kernan, CFA, Vivien Azer, John Blackledge, Andrew Charles, CFA, Oliver Chen, CFA, George Mihalos

A PRIMER ON US RENEWABLE DIESEL

June 17, 2020

Cowen Analyst: Jason Gabelman

COWEN'S BEST ESG INVESTMENT IDEAS FOR 2020

March 4, 2020

Authored by 32 Cowen Research Analysts

COWEN COMPANY COVERAGE

ACUITY BRANDS **AYI**
 ALPHABET **GOOG**
 AMTECH SYSTEMS **ASYS**
 AMPHENOL **APH**
 APTIV **APT**
 ARLO TECHNOLOGIES **ARLO**
 ARRAY TECHNOLOGIES **ARRY**
 BAKER HUGHES **BKR**
 BALLARD POWER SYSTEMS **BLDP**
 BLOOM ENERGY **BE**
 BORGWARNER **BWA**
 BP PLC **BP**
 CERENCE **CRNC**
 CHEVRON **CVX**
 CREE **CREE**
 ENPHASE ENERGY **ENPH**
 EVOQUA WATER TECHNOLOGIES **AQUA**
 EXXON MOBIL **XOM**
 FARFETCH **FTCH**
 FIRST SOLAR **FSLR**
 FISHER **FSR**
 FRESHII **FRIL.CN**
 FUELCELL ENERGY **FCEL**
 HANNON ARMSTRONG **HASI**
 ITRON **ITRI**
 LANDIS+GYR **LAND.SW**

LEAR **LEA**
 MELEXIS **MELE.BB**
 MUELLER WATER PRODUCTS **MWA**
 NIKOLA **NKLA**
 ORMAT TECHNOLOGIES **ORA**
 PENTAIR **PNR**
 PHILLIPS 66 **PSX**
 PLUG POWER **PLUG**
 ROYAL DUTCH SHELL **RDSA**
 SENSATA TECHNOLOGIES **ST**
 SMA SOLAR TECHNOLOGY **S92.GY**
 SOLAREDGE TECHNOLOGIES **SEDG**
 SUNPOWER **SPWR**
 TE CONNECTIVITY **TEL**
 TECHNIPFMC **FTI**
 TESLA **TSLA**
 THE REALREAL **REAL**
 TOTAL SA **TOT**
 TPI COMPOSITES **TPIC**
 UBER TECHNOLOGIES **UBER**
 VEONEER **VNE**
 VISTEON **VC**
 WATTS WATER TECHNOLOGIES **WTS**
 WESTPORT FUEL SYSTEMS **WPRT**
 WORKHORSE GROUP **WKHS**
 XYLEM **XYL**
 YUM! BRANDS **YUM**

SELECTED EVENTS

2020 COWEN ENERGY CONFERENCE

December 3-4, 2020

2ND ANNUAL PRIVATE COMPANY SUMMIT

October 21-22, 2020

GLOBAL TRANSPORTATION & SUSTAINABLE MOBILITY CONFERENCE

September 9-11, 2020

INDUSTRIAL TECHNOLOGY, ROBOTICS & SUSTAINABILITY CONFERENCE

June 1-3, 2020

2020 TECHNOLOGY, MEDIA & TELECOM CONFERENCE

May 26-29, 2020

COWEN TOWN HALL DISCUSSION WITH LEGENDARY INVESTOR JOHN ROGERS, FOUNDER AND CIO OF ARIEL INVESTMENTS

February 2020

ROBOTICS & AUTOMATION

Robotics & automation stands to benefit from unprecedented demand as a result of the COVID-19 crisis, digital transformation acceleration, and the importance of flexibility, scalability, and resiliency. We see a highly fragmented, largely private, North American-centric robotics landscape that is ripe for consolidation across verticals as diverse as grocery/consumables, health care and medical devices, and warehouse/logistics.

 **WATCH VIDEO** JOSEPH GIORDANO, CFA



WHAT WE'RE WATCHING

- Industrial & retail robotics
- Startup activity
- Increased deployment of automation and robotics in new end-markets
- Micro-fulfillment centers
- Last-mile delivery

RELATED THEMES

- Edge computing / 5G
- Mobility technology
- ESG & energy transition
- Consumer transformation



“COVID-19 continues to prove the case for further robotic deployment and automation in many end-markets.”

— **JOSEPH GIORDANO, CFA**

Using Machines To Talk Machines - Cowen's Robotics Conference



3.6x

ONLINE GROCERY SPEND HAS MORE THAN TRIPLED AS A PERCENT OF TOTAL GROCERY, DRIVING DEMAND FOR AUTOMATION SOLUTIONS

\$100B

TOTAL ADDRESSABLE MARKET



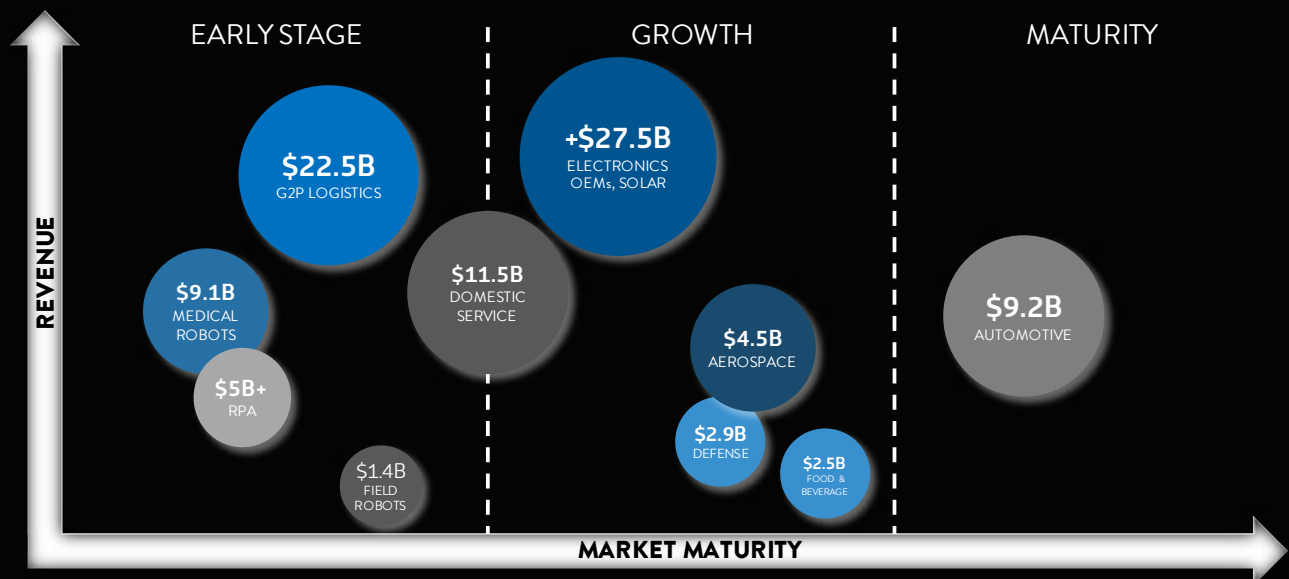
The Pandemic Has Served As An Accelerator Of Structural Trends

	COVID-19 should act as a catalyst for adoption of supply chain / warehouse automation and robotics.
	Some trends, like the shift to e-Commerce, are likely permanent.
	Ensuring business continuity is working itself into the customer pitch and return calculations.
	Commoditization of components allows suppliers to be flexible; interoperability is a critical focus for the broader market. Robot solutions are 90%+ software, which is the “special sauce” behind the solutions offered.
	Companies want greater business intelligence – need machine learning and AI to understand where, why, and what is happening because the current BI dashboard doesn’t scale well.
	New opportunities will emerge as a result of COVID-19 – must be evaluated for sustainability – perception of robotics has changed.

Source: Cowen and Company

The Money Pools For Robotics & Automation Are Large

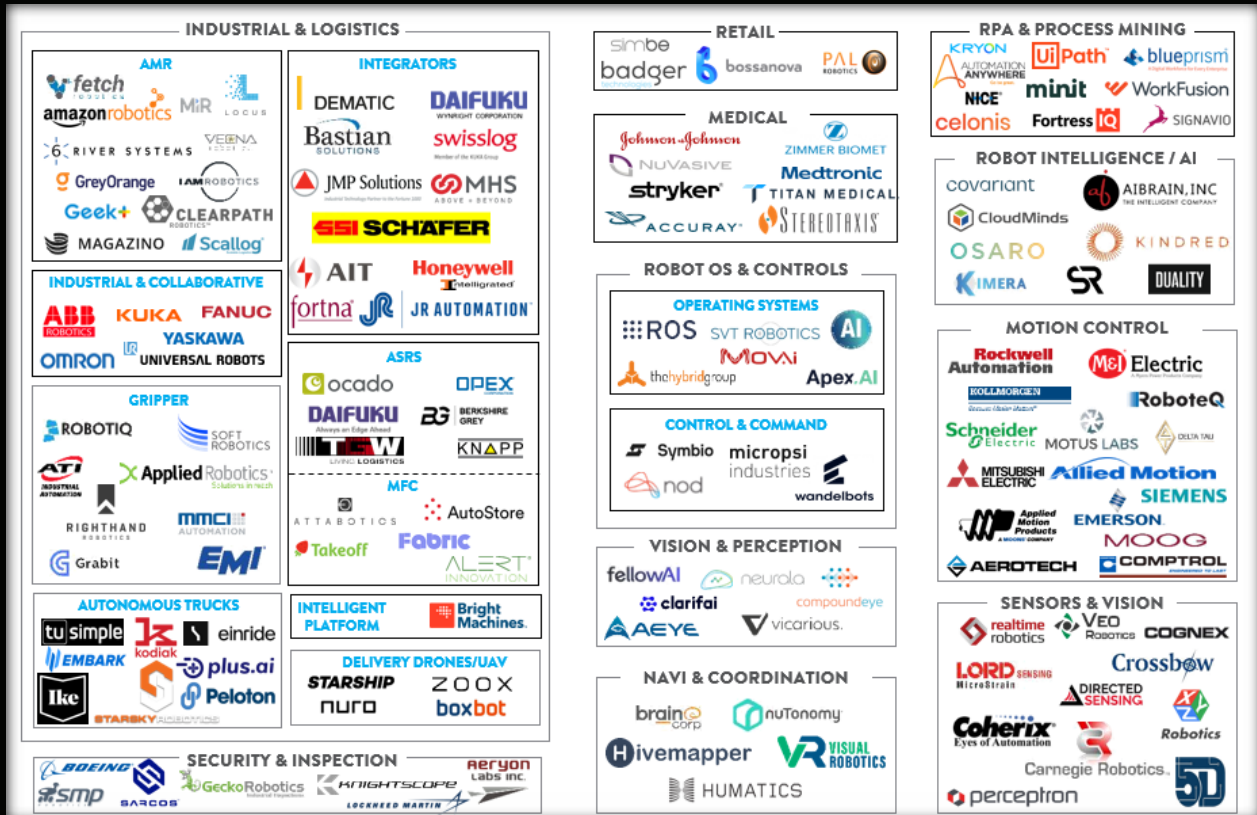
2022 GLOBAL ROBOTICS & AUTOMATION REVENUE FORECAST BY SUB-SEGMENT VS. MARKET MATURITY



Source: Cowen and Company



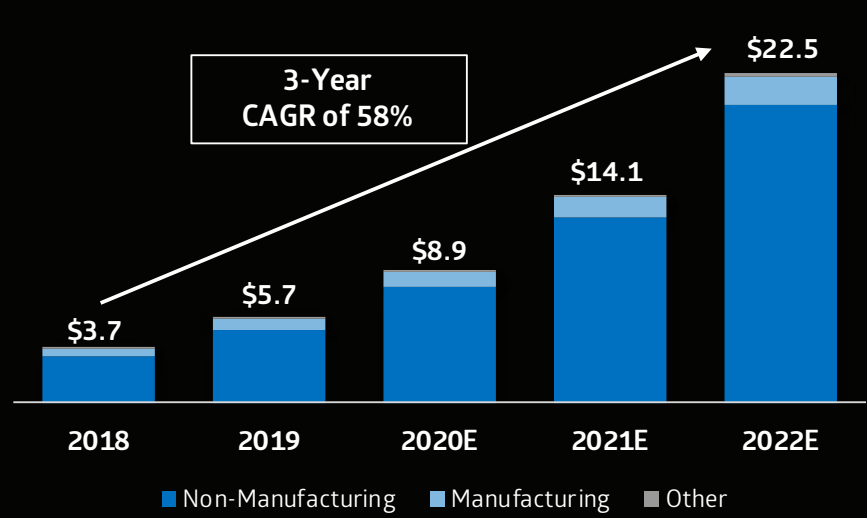
The Industry Is Largely Private And Many Will Look To Capitalize On The Growth Opportunity



Source: Cowen and Company

Warehouse Logistics Robotics Is Set Up For High Growth Driven By eCommerce

GLOBAL WAREHOUSE LOGISTICS ROBOTICS MARKET - \$ IN BILLIONS

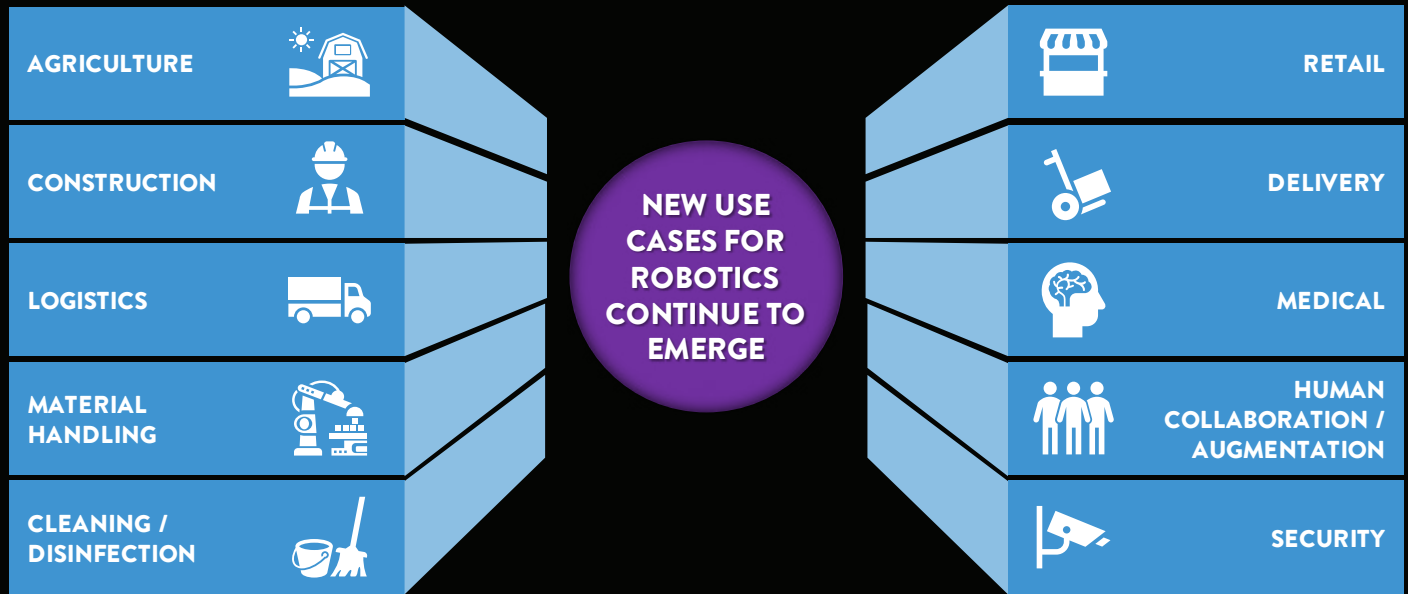


- ### DRIVERS
- Rapid eCommerce adoption
 - The need for speed, a new consumer requirement
 - Uncertainty
 - Labor shortages
 - Declining cost curve
 - Digitalization (i.e. machine learning, artificial intelligence, ubiquitous high-speed connectivity)

Source: Cowen and Company, IFR World Robotics 2019



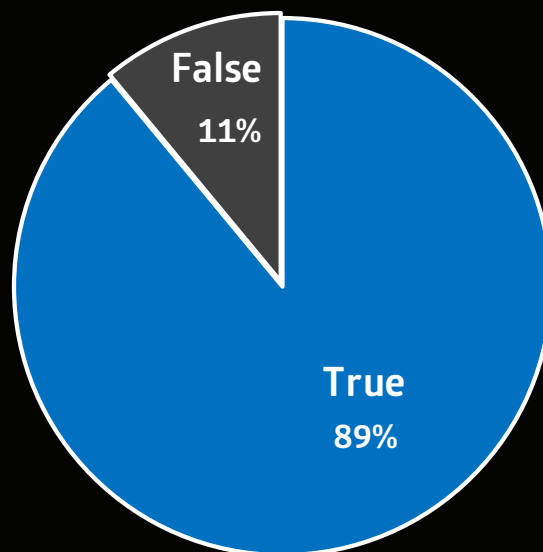
Tools And Automation Processes Used In Manufacturing Will Spread To Other Parts Of The Economy Undergoing Digital Transformation



Source: Cowen and Company

The Pandemic Is Accelerating Company Plans For Digital Transformation

MY COMPANY PLANS TO ACCELERATE DIGITAL TRANSFORMATION SPENDING AS A RESULT OF THE PANDEMIC. TRUE OR FALSE?



Source: Cowen and Company, IT Services Spending Survey, fielded in June 2020, N=163; powered by Qualtrics



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JEFFREY OSBORNE **CHRIS** KRUEGER
JOHN BLACKLEDGE **MATTHEW D.** RAMSAY
J. DERRICK WOOD, CFA **ROMAN** SCHWEIZER

REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES

THE IMPACT OF COVID-19 ON MEDICAL TECHNOLOGY CAPITAL SPENDING

October 9, 2020 and June 10, 2020
 Cowen Analyst: Joshua Jennings, M.D.

AHEAD OF THE CURVE® SERIES

RETAIL'S MODERNIZATION IMPERATIVE

July 21, 2020
 Cowen Analysts: Oliver Chen, CFA, Vivien Azer, Helane Becker, John Blackledge, Andrew Charles, CFA, Joseph Giordano, CFA, John Kernan, CFA, Kevin Kopelman, CFA

USING MACHINES TO TALK TO MACHINES - RECENT VIRTUAL ROBOT CONFERENCE ROUNDUP

September 23, 2020
 Cowen Analyst: Joseph Giordano, CFA

RPA/IA INSIGHTS VOL 24: UIPATH BREACHES \$10BN VALUATION; AUTOMATION GETS BIGGER

June 13, 2020
 Cowen Analyst: Bryan C. Bergin, CFA

AUTOMATING FULFILLMENT KEY TO SCALING ONLINE GROCERY: COWEN'S CEO PANEL

June 11, 2020
 Cowen Analyst: Oliver Chen, CFA, Joseph Giordano, CFA

ABB: INITIATE AT OUTPERFORM: THE NEW ABB, AGAIN - BUT FOR REAL THIS TIME

June 9, 2020
 Cowen Analyst: Joseph Giordano, CFA

COVID-19 PROVING THE CASE

April 15, 2020
 Cowen Analysts: Joseph Giordano, CFA

BONDING IN BOSTON WITH THE ROBOTICS COMMUNITY

February 3, 2020
 Cowen Analyst: Joseph Giordano, CFA

COWEN COMPANY COVERAGE

ABB **ABB**
 ACCENTURE **ACN**
 ACCURAY **ARAY**
 ALPHABET **GOOG**
 AMAZON.COM **AMZN**
 AMBARELLA **AMBA**
 ALPHABET **GOOG**
 APTIV **APTIV**
 COGNEX **CGNX**
 FEDEX CORP. **FDX**
 JOHNSON & JOHNSON **JNJ**
 LYFT **LYFT**

MEDTRONIC **MDT**
 NUVASIVE **NUVA**
 STEREOTAXIS **STXS**
 STRYKER CORP. **SYK**
 TARGET **TGT**
 TERADYNE **TER**
 UBER TECHNOLOGIES **UBER**
 UNITED PARCEL SERVICE **UPS**
 WALMART **WMT**
 XPO LOGISTICS **XPO**
 ZIMMER BIOMET HOLDINGS **ZBH**

SELECTED EVENTS

2020 RETAIL AUTOMATION SUMMIT

December 7, 2020

2020 MEDTOOLS CONFERENCE

October 15, 2020

BROADLINES & GROCERY EXECUTIVE SUMMIT

Retail Robotics and the Connected Store: In-Store Inventory Automation & Accuracy
 August 25, 2020

RETHINK RETAIL CEO SERIES

June 22-24, 2020

INDUSTRIAL TECHNOLOGY, ROBOTICS & SUSTAINABILITY SUMMIT

Panels With Bossa Nova, Alert Innovation, Righthand Robotics, Fabric, And Takeoff Technologies
 June 1-3, 2020

2020 TECHNOLOGY, MEDIA & TELECOM CONFERENCE

May 26-29, 2020

THE ONLINE GROCERY SURGE: COWEN'S EXPERT CONFERENCE CALL ON MICRO FULFILLMENT & SOFTWARE-LED ROBOTICS SOLUTIONS

May 6, 2020

ROBOTICS COMPANY EXPERT CALLS: COVID-19 PROVING THE CASE


April 2020

RETAIL AUTOMATION CALL: ALERT TRANSFORMING WMT'S IN-STORE GROCERY FULFILLMENT

January 21, 2020

NEW PARADIGMS IN COMPUTING

Digital transformation has accelerated, raising the importance and value of software and new development approaches. Companies are adopting new automation, collaboration & data analysis tools. Robotic Process Automation (RPA) offers ease and scalability of business process automation that presents a direct threat to traditional BPO and IT services providers. DevOps serves as the foundation for companies to build, test, and deploy software more quickly, reliably and securely, driving more software adoption and creating new markets. Human Capital Management software stands to benefit from increased demand for automation, efficiency, and engaging with employees in new ways.

 **WATCH VIDEO** J. DERRICK WOOD, CFA



WHAT WE'RE WATCHING

- Developers getting more budget authority
- Rising consumption of new Cloud data platforms
- Work-from-anywhere
- HCM new module innovations

RELATED THEMES

- Mobility technology
- Robotics & automation
- Consumer transformation
- Edge computing / 5G
- Big tech & government
- Election 2020



“RPA is the fastest growing category in enterprise software. Considering the magnitude of manual data collection and processing work activities across all companies, the addressable opportunity for RPA is enormous. Market entry, via M&A, by a growing list of enterprise software providers is supportive of its future growth potential.”

— **BRYAN C. BERGIN, CFA**
RPA/IA Insights



>100X

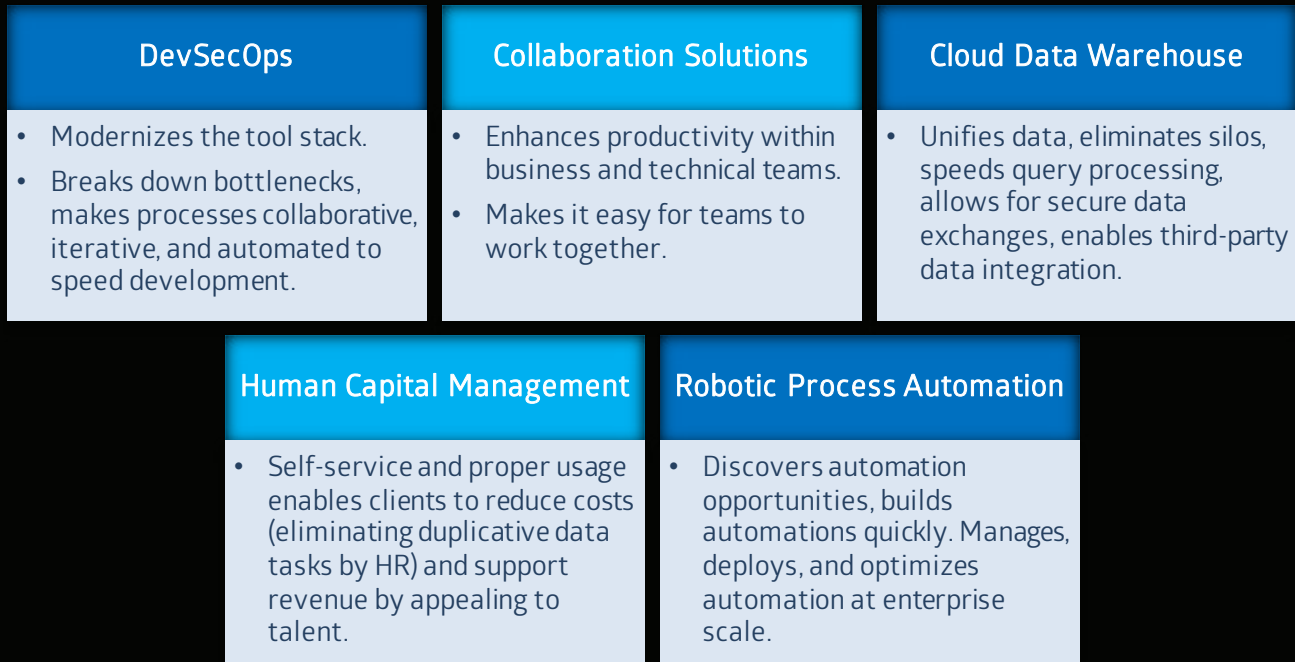
FASTER CADENCE OF SOFTWARE
DEPLOYMENT BY DEVSECOPS LEADERS
VS. LOW-PERFORMING PEERS

40%

OF SMBS SOLVE FOR PAYROLL USING
LEGACY METHODS



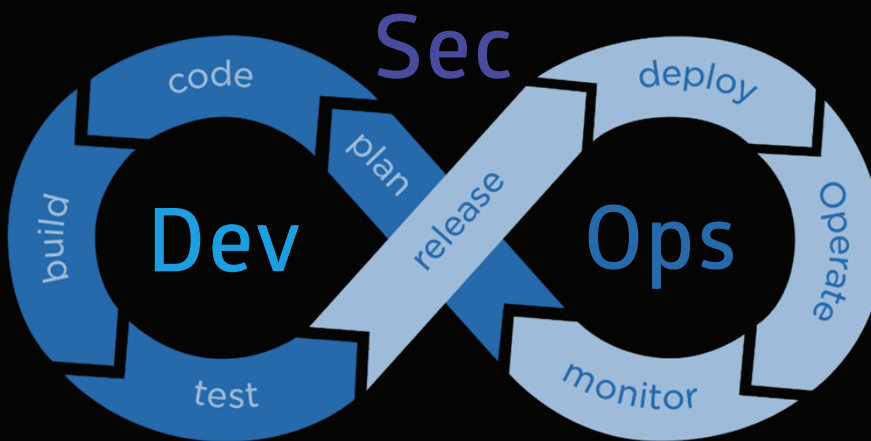
New Computing Approaches Are Supporting Digital Transformation



Source: Cowen and Company

DevSecOps Methodologies Introduce A Radically Different Way To Build, Update & Deploy Software

DEVSECOPS LIFE CYCLE



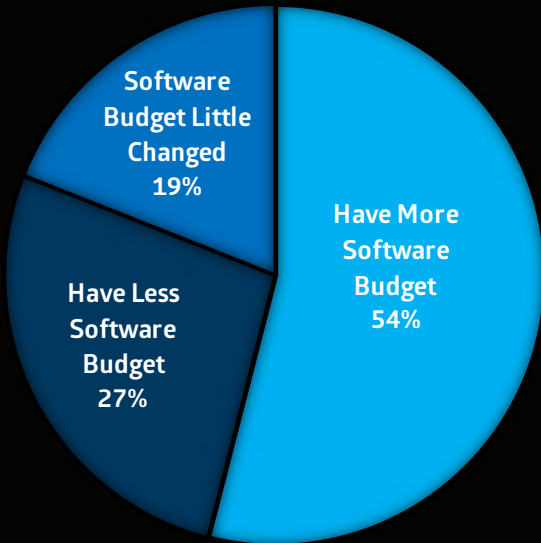
DevSecOps represents a new paradigm around how companies build, release and deploy software, and it's a method that has evolved from past approaches including Agile and Waterfall development.

Source: Cowen and Company, Medium



COVID Has Been A Catalyst For DevSecOps Spending. 54% Of Respondents Have More Budget Post COVID, And Respondents Expect 10% Growth In 2021

HOW HAS COVID-19 IMPACTED SPENDING ON DEVSECOPS INITIATIVES?



BY THE NUMBERS

- 10% expected DevSecOps growth in 2021 vs. 8% in 2020.
- Post-COVID and looking forward, the most strategic initiatives are IT service management, software build and supply chain management, security & vulnerability management.

Source: Cowen and Company Software Survey (n=105), October 2020

DevSecOps Will Drive Tailwinds For A Select Group Of Public Software Companies And Open New Markets Addressed By New Private Companies

DEVSECOPS COMPETITIVE LANDSCAPE

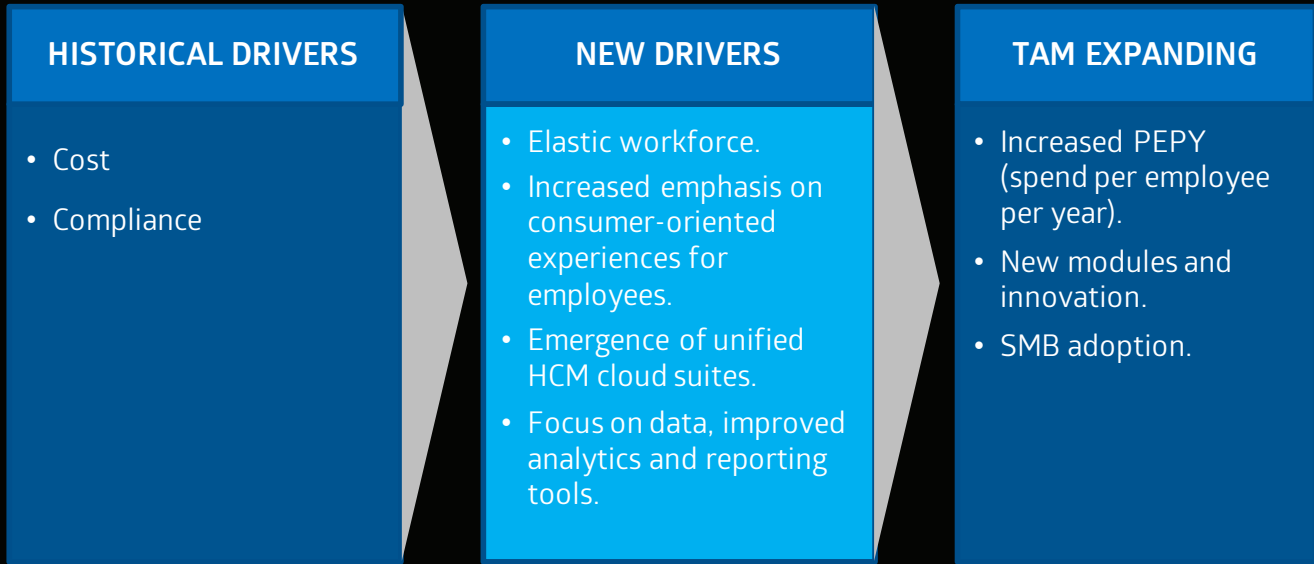


Source: Cowen and Company



The Secular Tailwinds Driving Enterprise Digital Transformation Are Also Permeating HCM And Boosting Growth In A Traditionally Steady Industry

FORCES SHAPING THE HCM MARKET



COWEN HCM COVERAGE



Source: Cowen and Company

Cowen Is Bullish On The Rise Of Cloud Data Platforms For Analytics And AI/ML



- ### DRIVERS
- Solves for storage challenges, workload challenges, siloed data challenges.
 - Rising demand for Big Data.
 - Powerful network effects related to data sharing.
 - Growing acceptance of Cloud and the flexibility it offers.
 - Cost savings.

Source: Cowen and Company, IDC, Gartner



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MATTHEW D. RAMSAY

REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES

DEVSECOPS: THE NEXT EVOLUTION IN THE DEVELOPER MODERNIZATION JOURNEY

December 11, 2020

Cowen Analyst: J. Derrick Wood, CFA

AHEAD OF THE CURVE® SERIES

SMB PAYROLL SURVEY: FERTILE GROUND FOR CLOUD PENETRATION

September 16, 2020

Cowen Analyst: Bryan C. Bergin, CFA

AHEAD OF THE CURVE® SERIES

FUTURE OF MOBILITY PRIMER

September 8, 2020

Cowen Mobility Technology Research Team

AHEAD OF THE CURVE® SERIES

PUBLIC CLOUD VIII: COVID-19 ACCELERATING MIGRATION IN 2020

May 28, 2020

Cowen Analysts: John Blackledge, Nick Yako, J. Derrick Wood, CFA, Bryan C. Bergin, CFA, Matthew D. Ramsay, Colby Synesael

AHEAD OF THE CURVE® SERIES

LIVIN' ON THE EDGE PART 4: SOFTWARE & SECURITY

May 21, 2020

Cowen TMT Team and Cowen Washington Research Group

AHEAD OF THE CURVE® SERIES

ON-DEMAND PAY: YOU'VE ALREADY EARNED IT

January 30, 2020

Cowen Analyst: Bryan C. Bergin, CFA

SNOWFLAKE: INITIATING AT OUTPERFORM; THE SLOPES ARE STEEP AND THE POW IS DEEP

October 12, 2020

Cowen Analyst: J. Derrick Wood, CFA

RPA/IA INSIGHTS VOL 24: UIPATH BREACHES \$10BN VALUATION; AUTOMATION GETS BIGGER

July 13, 2020

Cowen Analyst: Bryan C. Bergin, CFA

SLACK INITIATION: PICKING UP THE SLACK WITH AN OUTPERFORM AND \$45 PRICE TARGET

June 2, 2020

Cowen Analyst: J. Derrick Wood, CFA

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COWEN COMPANY COVERAGE

ACCENTURE **ACN**

ADOBE SYSTEMS **ADBE**

ALPHABET **GOOG**

ALTERYX **AYX**

AMAZON.COM **AMZN**

APPIAN CORPORATION **APPN**

ASURE SOFTWARE **ASUR**

ATLASSIAN **TEAM**

AUTOMATIC DATA PROCESSING **ADP**

CERIDIAN HCM HOLDINGS **CDAY**

COGNIZANT TECHNOLOGY SOLUTIONS CORP. **CTSH**

DOMO **DOMO**

ENDAVA **DAVA**

EPAM SYSTEMS **EPAM**

HUBSPOT **HUBS**

MICROSOFT **MSFT**

NEW RELIC **NEWR**

ORACLE **ORCL**

PAYCHEX **PAYX**

PAYCOM SOFTWARE **PAYC**

PAYLOCITY HOLDING CORPORATION **PCTY**

RIMINI STREET **RMNI**

SALESFORCE.COM **CRM**

SAP (ADR) **SAP**

SERVICENOW **NOW**

SLACK TECHNOLOGIES **WORK**

SNOWFLAKE **SNOW**

SPLUNK **SPLK**

SUMO LOGIC **SUMO**

TERADATA **TDC**

TWILIO **TWLO**

WORKDAY **WDAY**

ZENDESK **ZEN**

SELECTED EVENTS

2020 SOFTWARE BUS TOUR

November 9, 2020

2ND ANNUAL PRIVATE COMPANY SUMMIT

October 21-22, 2020

48TH ANNUAL TECHNOLOGY, MEDIA & TELECOM CONFERENCE

May 26-29, 2020

2020 PRIVATE COMPANY SPOTLIGHT

April 7-Ongoing, 2020

CONSUMER TRANSFORMATION

Digital adoption has raced forward, by necessity. COVID has increased the centrality of the home and redefined the things that one does from home: eCommerce, grocery shopping, work, entertainment, fitness, restaurant food delivery, health care delivery. Additionally, the drivers of preference are different for next-gen consumers who prioritize frugality, social impact and sustainability. Disruptive innovation typically spurts forward in times of crisis because innovations tend to do better on a “clean slate” basis. How consumers exit the crisis will be less about legacy decisions carried forward than the new things tried and preferred.

 **WATCH VIDEO** JOHN BLACKLEDGE



WHAT WE'RE WATCHING

- Big tech strategic developments
- Underpenetrated e-Commerce verticals
- Category consolidation
- Reopening physical store productivity
- Cowen consumer tracker
- Customer acquisition & engagement
- Improving digital unit economics

RELATED THEMES

- Big tech & government
- Mobility technology
- Robotics & automation



“The crisis is a catalyst for innovation as we forecast consumers will accelerate adoption of Re-Commerce & online grocery as they pivot toward value and blend digital & physical interactions.”

— **AHEAD OF THE CURVE® SERIES REPORT**

Retail's Modernization Imperative



137%

PELOTON CONNECTED SUBSCRIBER
GROWTH IN THE QUARTER ENDED
SEPTEMBER 2020

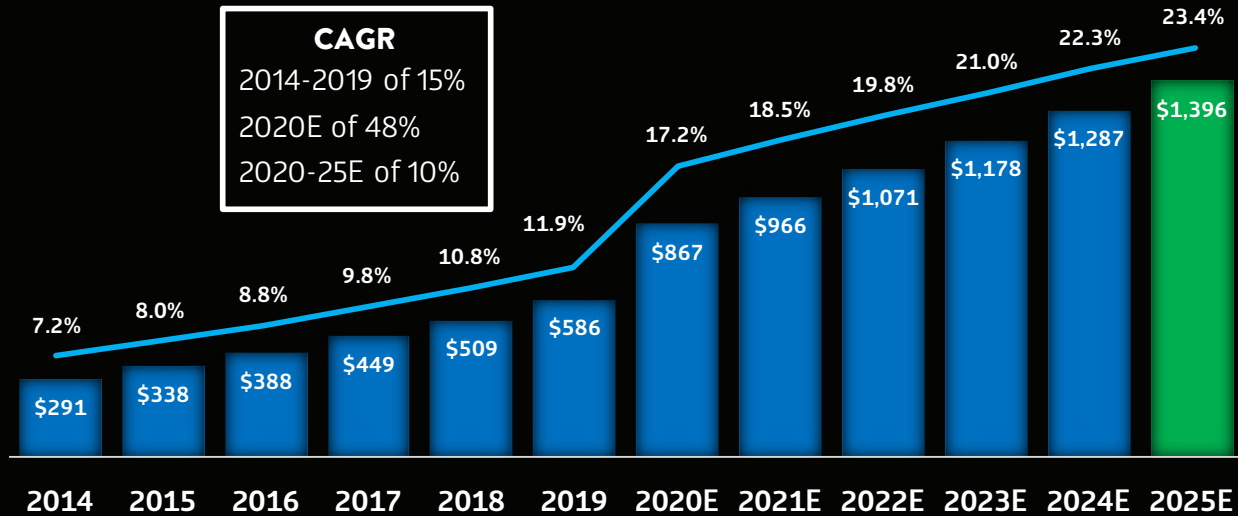
92%

PERCENTAGE OF PHYSICIANS WHO
EXPECT TO CONTINUE VIDEO VISITS
AFTER THE PANDEMIC



eCommerce Has Advanced 5 Years In 9 Months

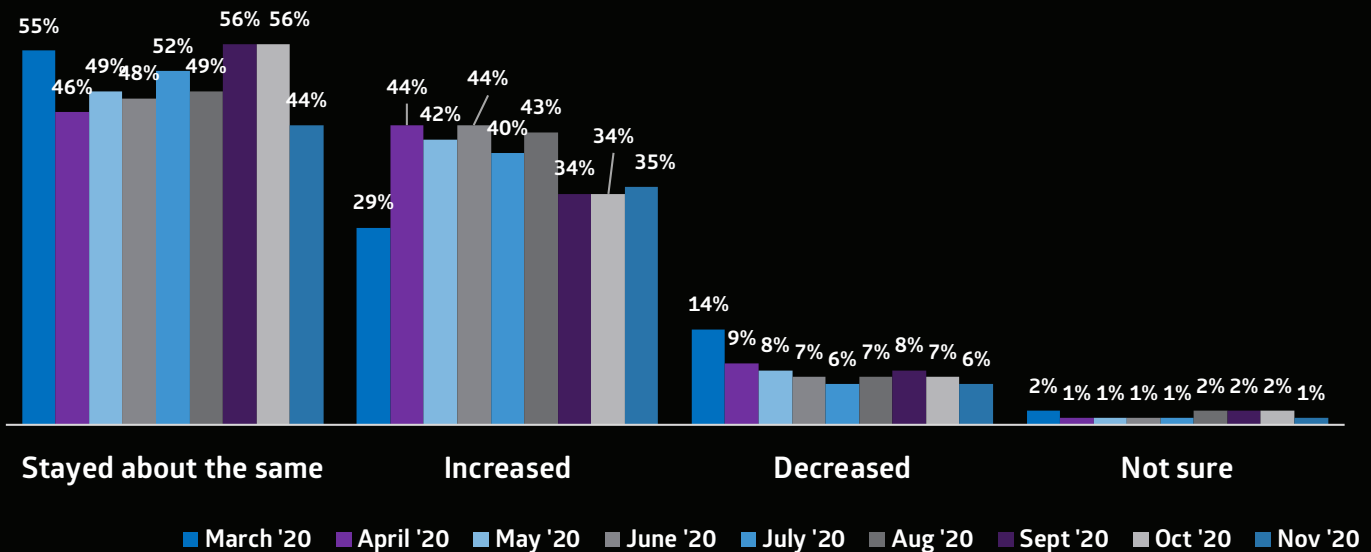
U.S. E-COMMERCE SALES AND PENETRATION, HISTORICAL AND FORECASTED, \$ IN BILLIONS



Source: Cowen and Company; U.S. Census Bureau. Note: the penetration rates exclude gas and non-merchandise receipts

We Believe New Behaviors Will Prove Sticky: eCommerce Spending Remains Elevated Despite Numerous Brick & Mortar Store Reopenings

OVER THE PAST 30 DAYS HOW HAS YOUR ONLINE PURCHASING CHANGED DUE TO COVID-19?

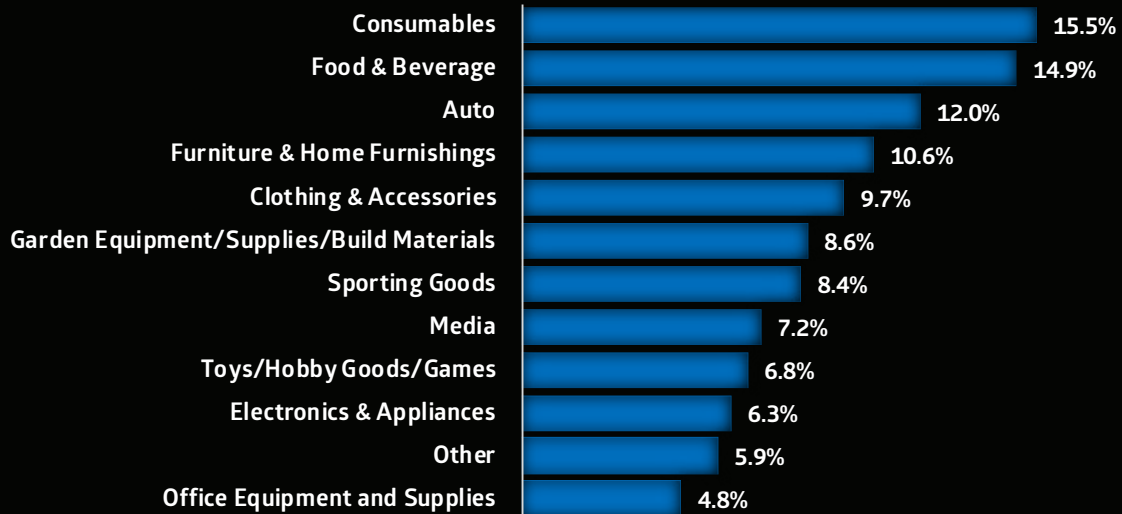


Source: Cowen COVID-19 US Internet Consumer Tracker, September '20 (N=2,500)



We Believe The Next Leg Of eCommerce Growth Will Be Led By Consumables (i.e., Health, Wellness, Beauty, Personal Care, HH Items, Baby & Pet Food) And Food & Beverage

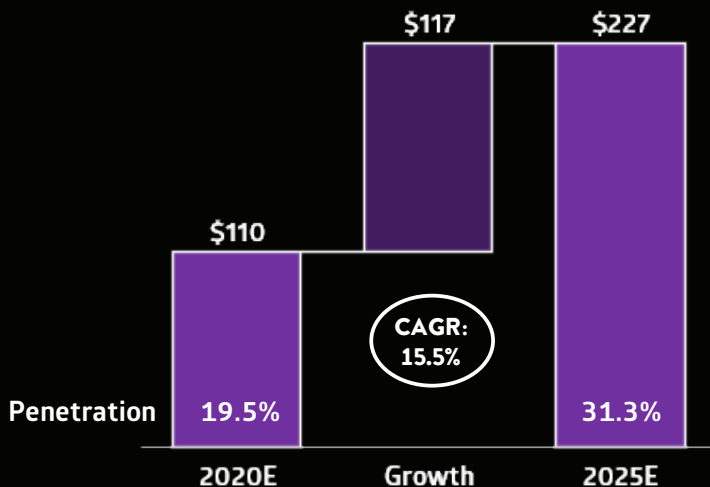
U.S. E-COMMERCE GROWTH FORECAST BY VERTICAL, 2020-2025



Cowen and Company; U.S. Census Bureau

We Forecast A Doubling In eCommerce In The Consumables Vertical Over The Next 5 Years

U.S. FORECAST FOR ONLINE SALES OF CONSUMABLES, 2020-2025, \$ IN BILLIONS



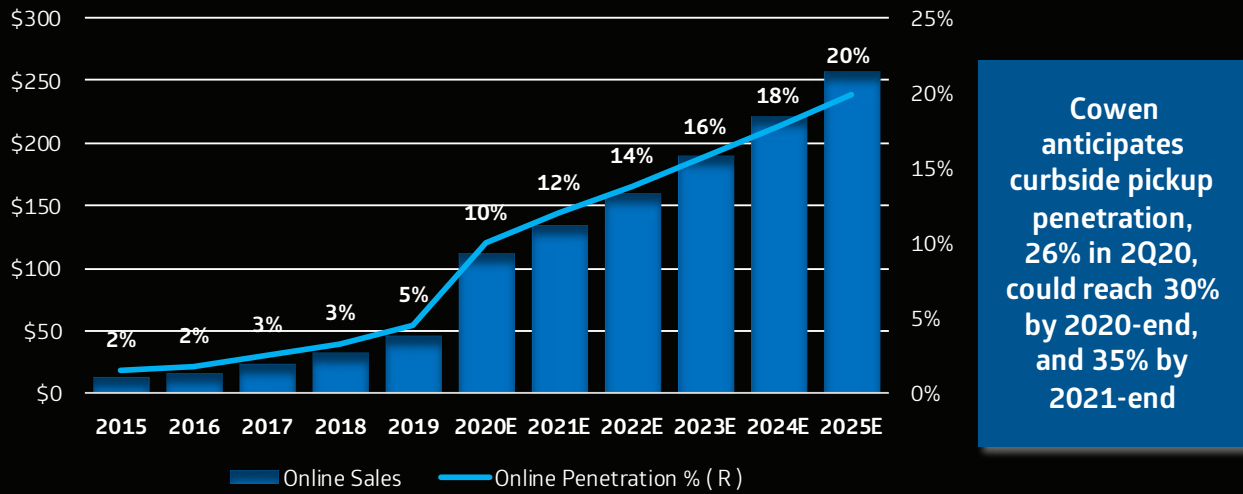
Source: Cowen and Company; U.S. Census Bureau

CONSUMABLES DIGITAL-NATIVE COMPETITIVE LANDSCAPE



Online Grocery Sales Have Spiked. We Believe Adoption Will Remain Sticky Given High Convenience And Value Factors. Penetration Could Reach 20% In 2025

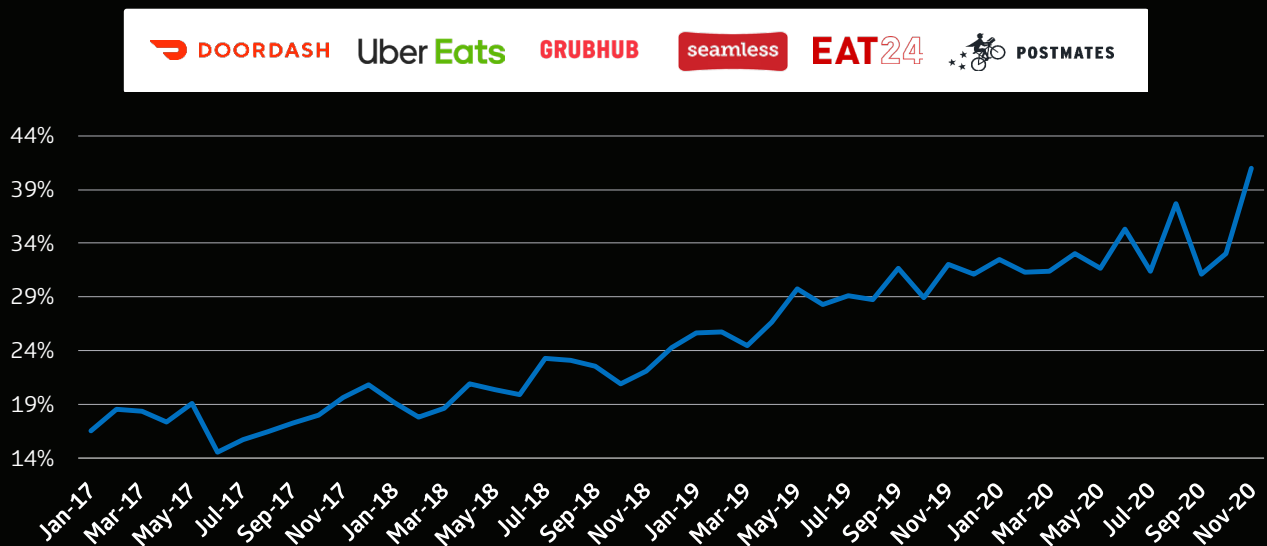
U.S. ONLINE GROCERY SALES AND PENETRATION, \$ IN BILLIONS



Source: Cowen and Company, Bureau Of Economic Analysis.

The Pandemic Has Strengthened Restaurant Delivery's Purpose, Stimulating Trial And Awareness

UNIQUE MAU PENETRATION FOR BIG 4 DELIVERY SERVICES

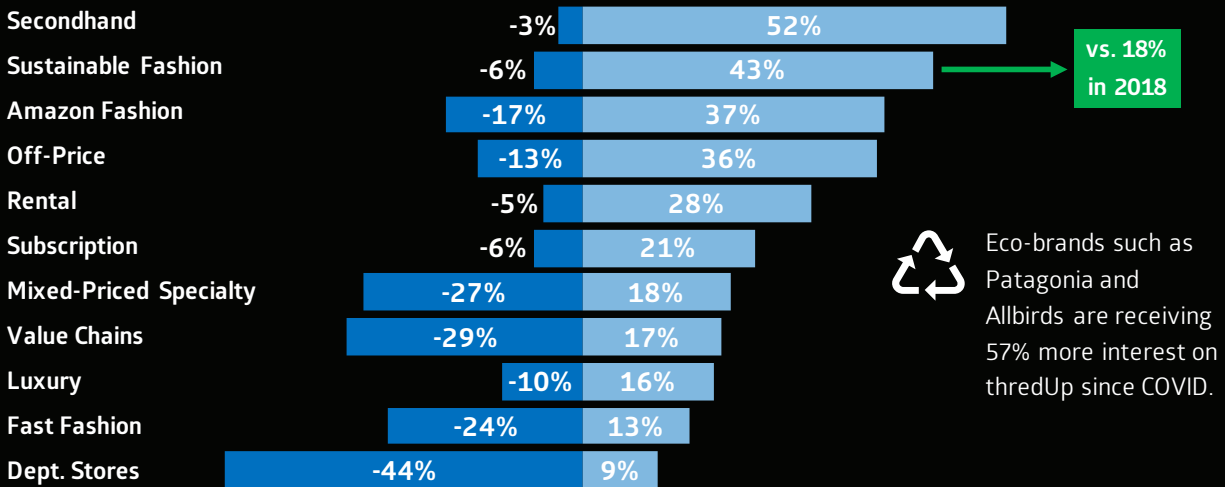


Source: Cowen and Company, Cowen Consumer Tracker N = 2500; Question: Which of these online food delivery services have you used in the last 30 days? Data represents Unique Monthly Active Users.



COVID-19 Has Sparked Greater Prioritization Of Secondhand And Sustainable Fashion. We Believe Online Resale Will Become A Mainstream Behavior

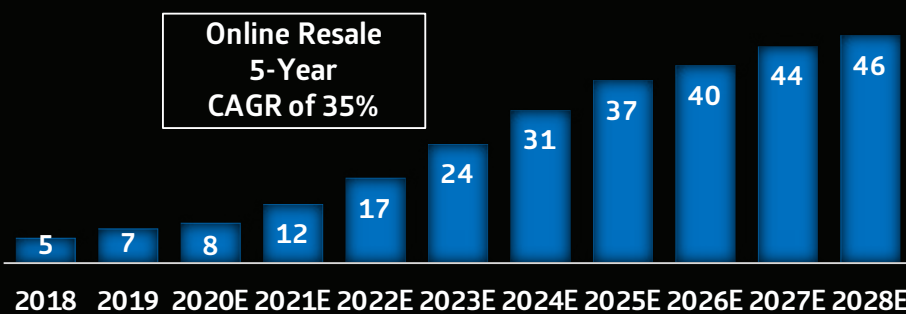
WHERE SHOPPERS PLAN TO SPEND LESS OR MORE MONEY OVER THE NEXT 5 YRS.



Source: Cowen and Company; thredUP 2020 Resale Report: n=3,500 women, 12/12/19 – 1/6/20 and n=2,000 in April 2000

We Expect Online Resale To Grow More Than 4x Over The Next Five Years

COWEN'S U.S. RESALE GROWTH ESTIMATE, \$ IN BILLIONS



LEADING ONLINE RESALE PLATFORMS

TheRealReal THREDUP POSHMARK ebay FASHIONPHILE craigslist
 Facebook Marketplace AptDeco GOAT FARFETCH TRADESY stockX
 Etsy OfferUp TRUE FACET WORTHY YOOGISCLOSET REBAG patagonia
 KARDASHIAN KLOSET Chairish STADIUM GOODS GLAMBOT WORN WEAR

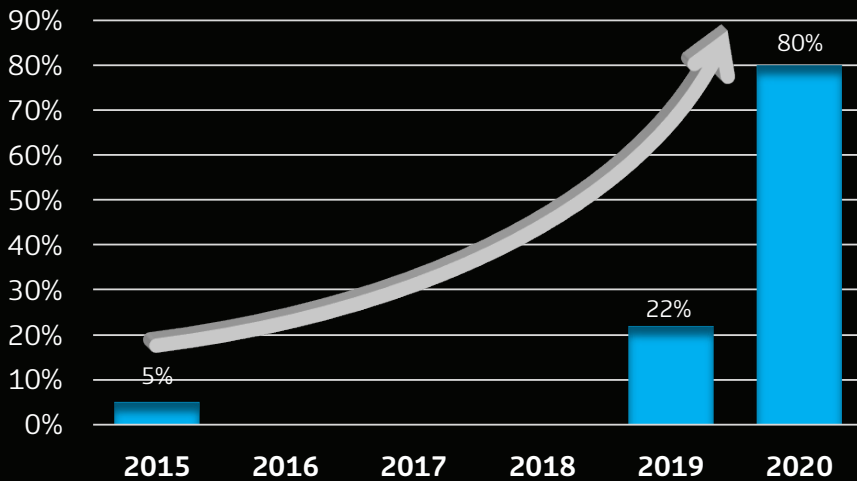
- Winning Online Platforms Will:**
- Offer goods that address a large TAM.
 - Sustain increased demand and efficiently acquire new customers.
 - Deliver a superior user experience.
 - Lead in logistics.
 - Employ a scalable business model.

Source: Cowen and Company; thredUP 2020 Resale Report



COVID Has Transformed Health Care Delivery And We Believe Telehealth Growth Will Be Permanently Higher Post COVID-19

PERCENT OF PHYSICIANS WHO HAVE HAD A VIDEO VISIT, \$ IN THOUSANDS



92% of physicians expect to continue video visits after the pandemic

- High employee satisfaction
- More competitive benefit package
- Lower medical costs

Source: Amwell 2020 Physician and Consumer Survey, Cowen and Company

The Telehealth Competitive Landscape Is Fragmented With Many Small Players Offering Targeted Solutions And Very Few Integrated Offerings

GENERAL MEDICINE

URGENT CARE

SECOND OPINION & SPECIALISTS

BEHAVIORAL HEALTH

CHRONIC CARE MANAGEMENT & RPM

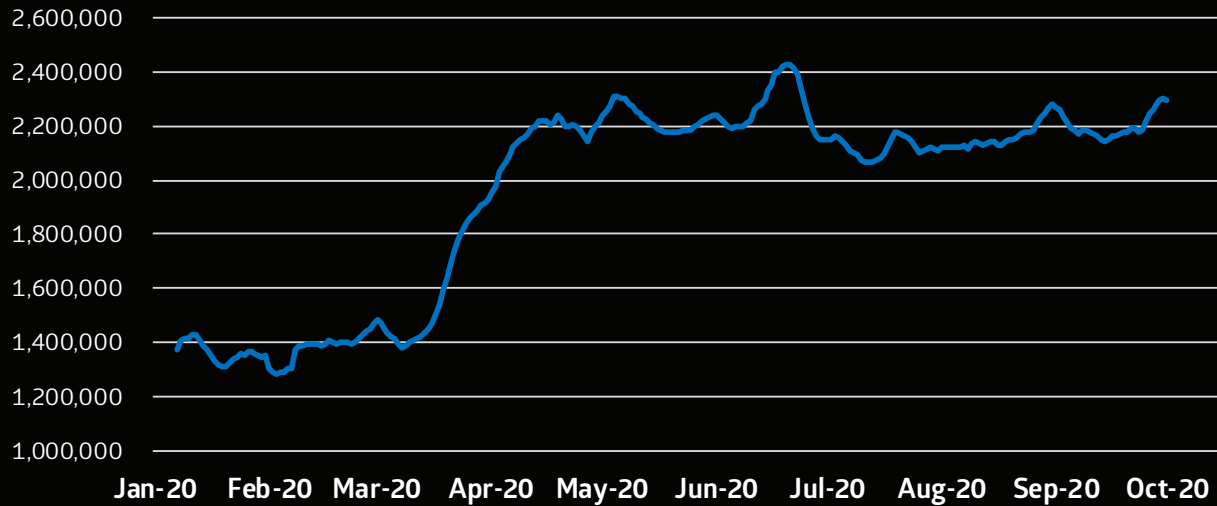
HARDWARE & CARTS

Source: Cowen and Company, Company Reports



Video Games Have Benefited Significantly From Shelter-In-Place. Though Viewership Will Dissipate Upon Normalization, We Believe Some Incremental Revenue Will Stick

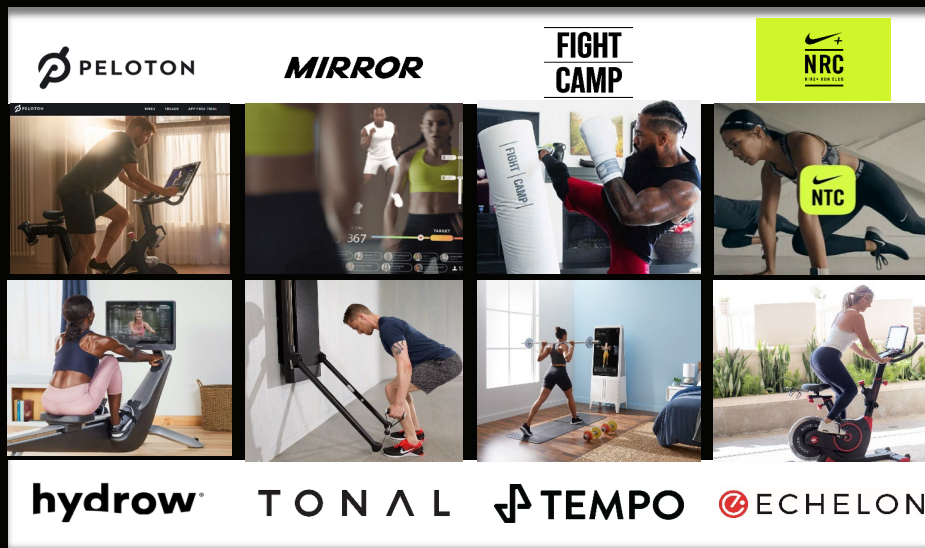
AVERAGE TOTAL TWITCH VIEWERS (LESS 65% OF VALORANT VIEWERSHIP DURING BETA KEY PROMOTION), T4W AVERAGE, JANUARY – OCTOBER 2020



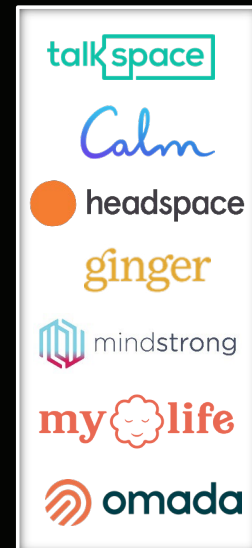
Source: Twitch Tracker and Cowen and Company

Health & Wellness Adaptations And Innovations, Tried And Preferred, Will Create Lasting New Habits

TECH-ENABLED GROUP FITNESS



DIGITAL WELLNESS

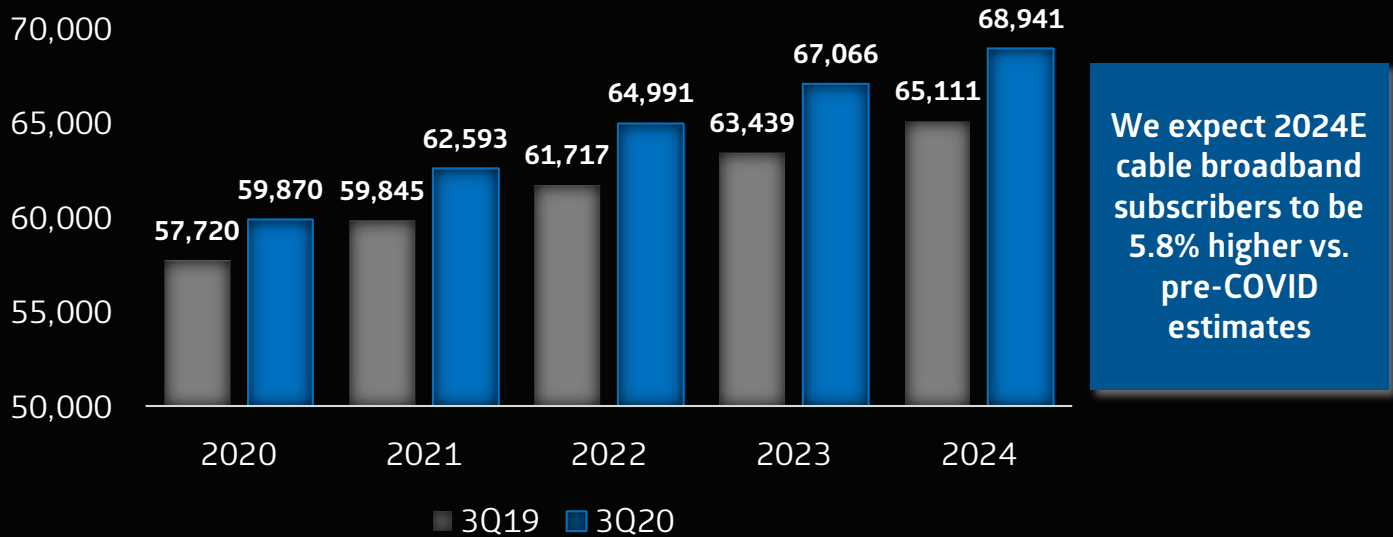


Source: Cowen and Company



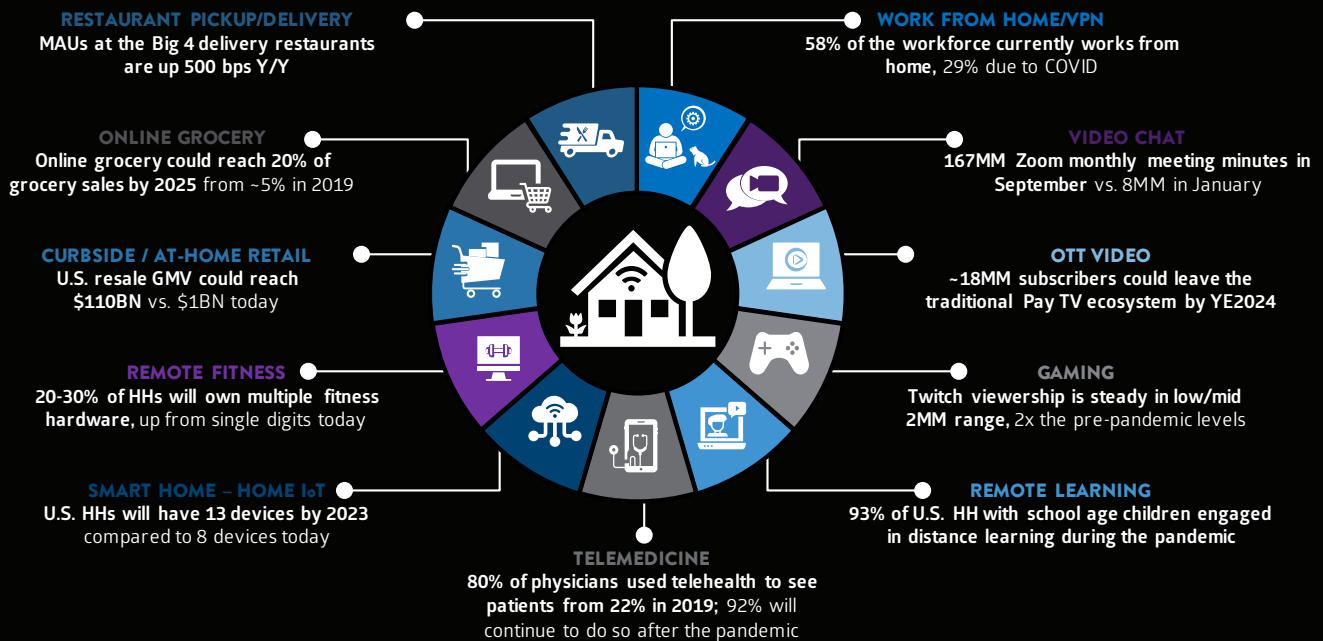
The "Everything From Home" Lockdown Has Amplified The Criticality Of Broadband. We Believe Cable Has An Advantage

COWEN BIG 3 CABLE BROADBAND SUBSCRIBER ESTIMATES PRE VS. POST COVID, \$ IN THOUSANDS



Source: Company reports, Cowen and Company estimates

The In-Home Applications Arising From Digital Transformation



Source: Cowen and Company, Company reports, Amwell 2020 Physician and Consumer survey



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GERALD PASCARELLI, CFA

REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES THERE'S NO PLACE LIKE HOME

November 20, 2020

Cowen Analysts: Gregory Williams, CFA, Colby Synesael, Paul Silverstein, Doug Creutz, CFA, John Blackledge, Charles Rhyee, Oliver Chen, CFA, Andrew M. Charles, CFA, John Kernan, CFA

AHEAD OF THE CURVE® SERIES GEN Z/MILLENNIALS: SUSTAINABILITY SUPPORTS DURABILITY

October 14, 2020

Cowen Analysts: John Kernan, CFA, Vivien Azer, John Blackledge, Andrew M. Charles, CFA, Oliver Chen, CFA, George Mihalos

AHEAD OF THE CURVE® SERIES U.S. ECOMMERCE DISRUPTION 4.0: COVID-19 CHANGES THE GAME

October 12, 2020

Cowen Analyst: John Blackledge

AHEAD OF THE CURVE® SERIES RETAIL'S MODERNIZATION IMPERATIVE

July 21, 2020

Cowen Analysts: Oliver Chen, CFA, Vivien Azer, Helane Becker, John Blackledge, Andrew M. Charles, CFA, Joseph Giordano, CFA, John Kernan, CFA, Kevin Kopelman, CFA

AHEAD OF THE CURVE® SERIES COVID-19 RECOVERY: TOO FAST, TOO SLOW, WHERE TO GO?

June 5, 2020

Cowen Analysts: Vivien Azer, Helane Becker, John Blackledge, Andrew M. Charles, CFA, Oliver Chen, CFA, Doug Creutz, CFA, John Kernan, CFA, Kevin Kopelman, CFA, George Mihalos, Jason H. Seidl, Chris Krueger, Jaret Seiberg

AHEAD OF THE CURVE® SERIES ASSESSING AMZN'S NON-US ECOMMERCE & PRIME OPPORTUNITY

March 10, 2020

Cowen Analyst: John Blackledge

AHEAD OF THE CURVE® SERIES TELEHEALTH SERIES PART 1: PAYING FOR TELEHEALTH

February 24, 2020

Cowen Analysts: Charles Rhyee, Eric Assaraf, Paul Gallant, Rick Weissenstein

COWEN COMPANY COVERAGE

ACTIVISION BLIZZARD **ATVI**
 ADIDAS **ADS.GR**
 ALPHABET **GOOG**
 AMAZON.COM **AMZN**
 AMERICAN OUTDOOR BRANDS **AOUT**
 AMWELL **AMWL**
 AT&T **T**
 BOSTON BEER COMPANY **SAM**
 BURLINGTON STORES **BURL**
 CABLE ONE **CABO**
 CALLAWAY GOLF **ELY**
 CARVANA **CVNA**
 CHARLOTTE'S WEB **CWBHF**
 CHARTER COMMUNICATIONS **CHTR**
 CHIPOTLE MEXICAN GRILL **CMG**
 COLUMBIA SPORTSWEAR **COLM**
 COMCAST **CMCSA**
 CONSTELLATION BRANDS **STZ**
 CORSAIR GAMING **CRSR**
 CV SCIENCES **CVSI**
 DECKERS OUTDOOR CORP. **DECK**
 DICK'S SPORTING GOODS **DKS**
 EBAY **EBAY**
 ELECTRONIC ARTS **EA**
 EVO PAYMENTS **EVOP**
 FACEBOOK **FB**
 FARFETCH LIMITED **FTCH**
 FRESHII **FRII.CN**
 GLOBAL PAYMENTS **GPN**
 GLU MOBILE **GLUU**
 GOODRX **GDRX**

GROCERY OUTLET HOLDING **GO**
 GRUBHUB **GRUB**
 IAC/INTERACTIVECORP **IAC**
 I3 VERTICALS **IIIV**
 LYFT **LYFT**
 MASTERCARD **MA**
 MATCH GROUP **MTCH**
 MERCADOLIBRE **MELI**
 NEPTUNE WELLNESS SOLUTIONS **NEPT.TO**
 NETFLIX **NFLX**
 NIKE **NKE**
 NUVEI **NVEI.T**
 ONTRAK **OTRK**
 PAYPAL **PYPL**
 PELETON INTERACTIVE **PTON**
 REVOLVE GROUP **RVLV**
 ROSS STORES **ROST**
 SQUARE **SQ**
 SEA LIMITED **SE**
 SNAP **SNAP**
 STARBUCKS **SBUX**
 TAKE-TWO INTERACTIVE **TTWO**
 TARGET **TGT**
 TELADOC HEALTH **TDOC**
 THE REALREAL **REAL**
 TWITTER **TWTR**
 UBER TECHNOLOGIES **UBER**
 VERIZON COMMUNICATIONS **VZ**
 VISA **V**
 WALMART **WMT**
 WAYFAIR **W**
 YETI HOLDINGS **YETI**
 ZYNGA **ZNGA**

SELECTED EVENTS

TOUR DE TOTE
November 9, 2020

2020 BROADLINE & GROCERY EXECUTIVE SUMMIT
August 25, 2020

2020 INTERNET BUS TOUR
August 10-14, 2020

2020 COMMUNICATIONS INFRASTRUCTURE SUMMIT
August 11-12, 2020

2020 NEW RETAIL ECOSYSTEM SUMMIT
June 9, 2020

2020 HEALTH, WELLNESS, & BEAUTY SUMMIT
June 2, 2020

CONSUMER PLATFORMS FOR THE NEXT GENERATION SUMMIT
May 27, 2020

DIGITAL DINING SUMMIT
May 27, 2020

ICR 2020
January 13-15, 2020

CANNABIS

The Cannabis industry will enter 2021 with continued momentum. On November 3rd, a “Green Wave” was evident at the state and local level, as all six cannabis-related ballot measures were passed. Ballot knock-on effects, coupled with COVID-19 budget deficits, will push other states to legalize adult use, potentially adding another \$6B to our \$34B U.S. legal TAM by 2025. Longer-term, the generational challenge for enactment at the Federal level should ease, and the addressable opportunity could multiply.

 **WATCH VIDEO** VIVIEN AZER



WHAT WE'RE WATCHING

- New adult use ballot states
- State legislative changes
- Market share Consolidation
- Profitability
- Cash flows

RELATED THEMES

- Consumer transformation
- Election 2020
- Targeted therapies
- CNS



“Adult use legalization in NJ could serve as more than enough of a catalyst to set off a domino effect on surrounding Northeast states.”

— **VIVIEN AZER**

Cowen's Cannabis Catalyst Series Part 2 — Knock-on Effects: Ballots And Budgets



34%

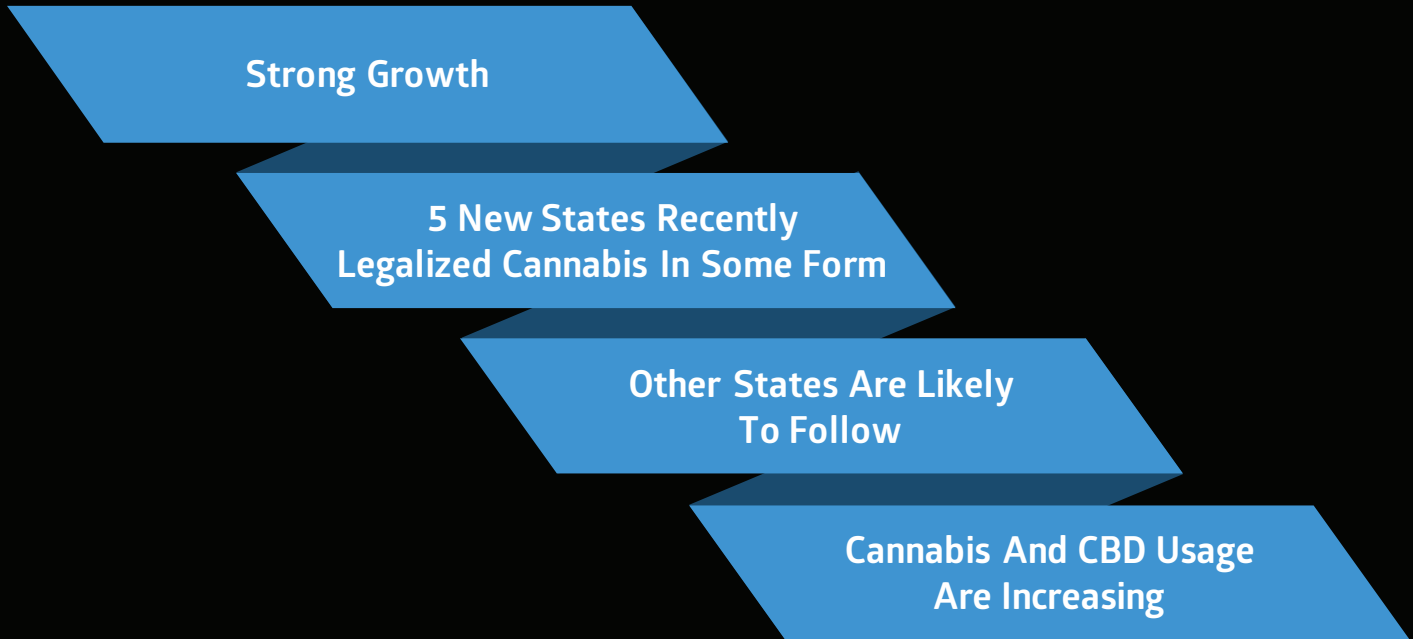
OF THE U.S. POPULATION RESIDE
IN A STATE WHERE ADULT USE
CANNABIS IS LEGALIZED

65%

OF CBD CONSUMERS USE
SUPPLEMENTS DAILY OR WEEKLY



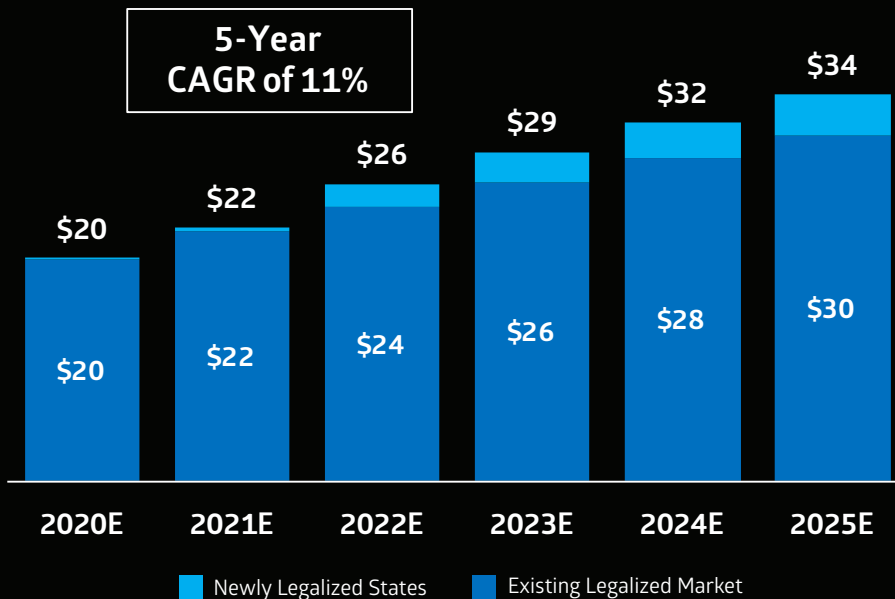
The Cannabis Industry Enters 2021 With Continued Momentum



Source: Cowen and Company

The U.S. Legal Cannabis Market Is Large: Forecasted To Reach \$34B By 2025

FORECASTED U.S. LEGAL CANNABIS TAM, \$ IN BILLIONS



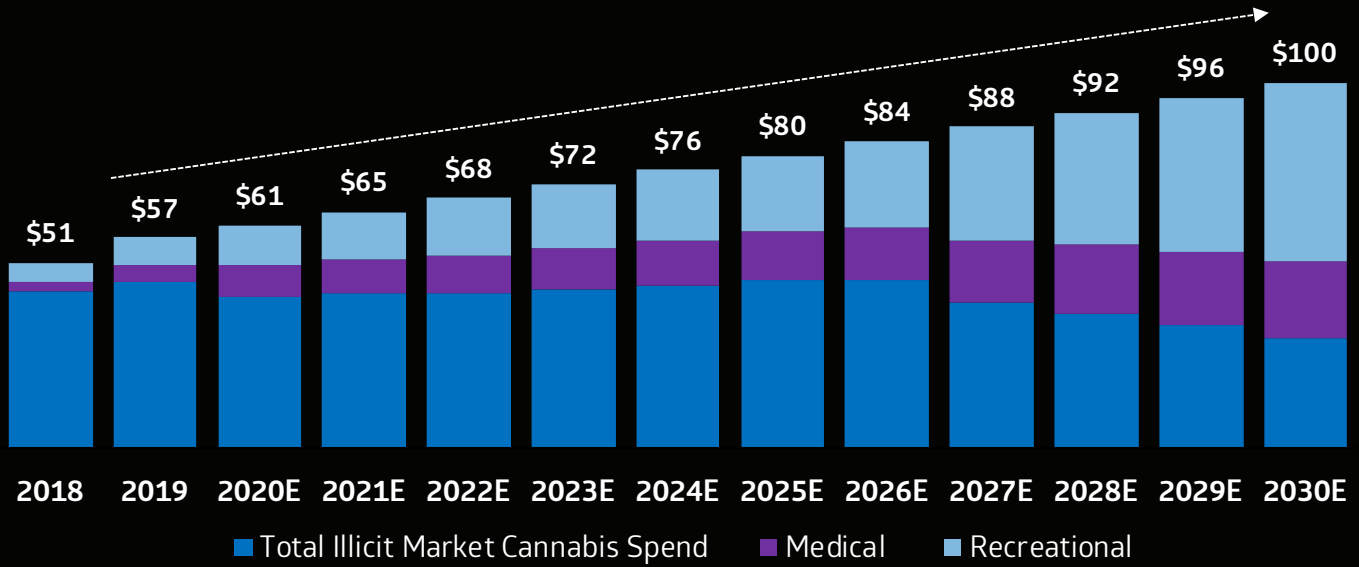
Approved ballot measures have increased our TAM by \$4B to \$34B in 2025.

- Adult use approved in NJ, AZ, MT, SD.
- Medical use approved in SD and MS.

Source: Cowen and Company

There Remains A Significant Opportunity To Transition A Large Illicit Market

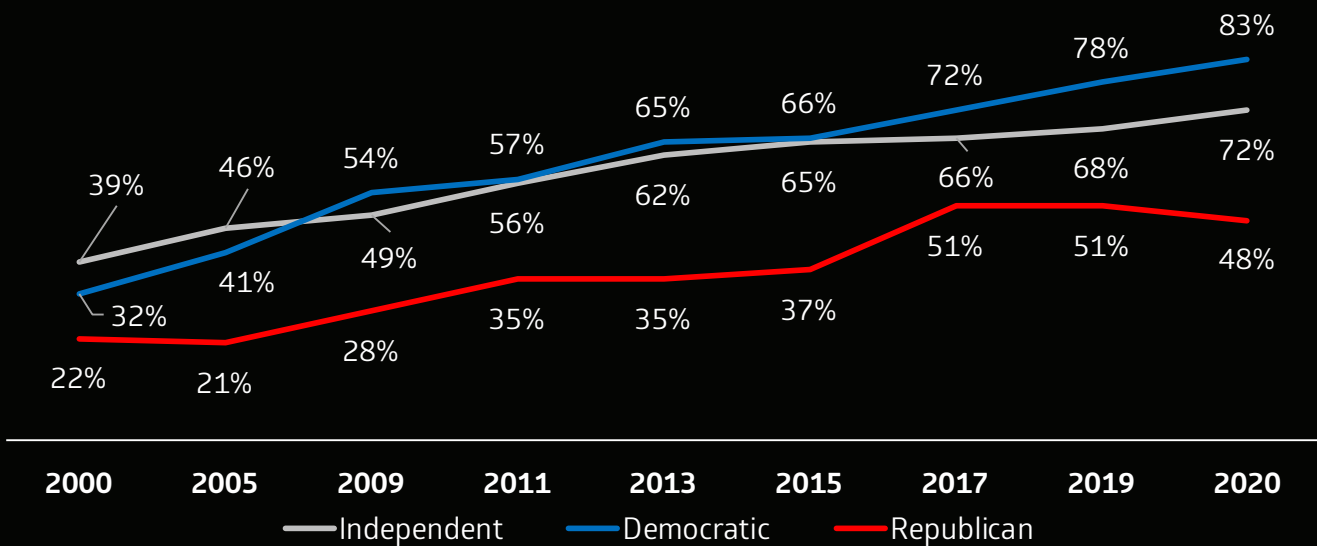
U.S. CANNABIS TAM, LEGAL PLUS ILLICIT, \$ IN BILLIONS



Source: Cowen and Company

Public Support Is Increasing And Momentum Is On The Side Of Legalization

PARTISAN SUPPORT FOR LEGALIZATION OF CANNABIS



Source: Gallup (n=1,000); Cowen and Company

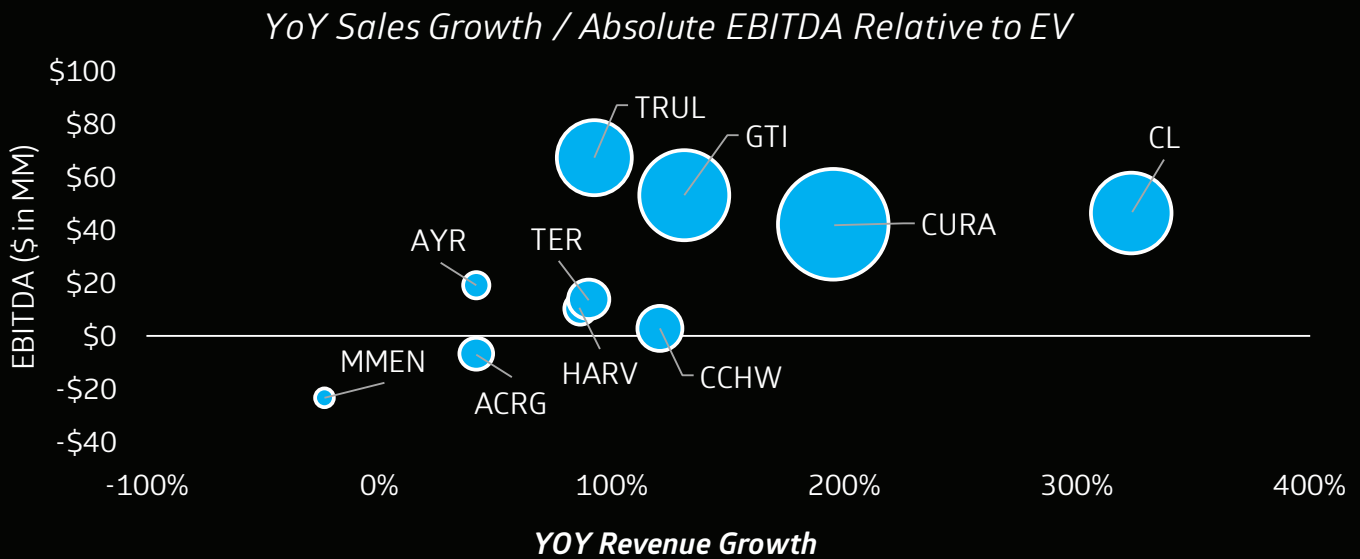


States Continue To Legalize Adult Use, However Cannabis Policy Is Not Likely To Be A Near-Term Federal Priority

- Ballot measures recently approved in 5 states.
- NJ’s legalization, coupled with COVID-19 budget deficits, could push NY, CT, and RI to legalize adult use, with PA a lower-probability possibility (in total a \$3-6B opportunity by 2025).
- The House recently voted in favor of the MORE Act, not expected to be passed by a Republican-controlled Senate.
- If control of the U.S. Senate changes, to be determined by the January 5, 2021 Georgia run-off, then there is the potential for positive incremental change in Cannabis policy.
- Cannabis policy is probably not a high Federal priority in the context of other major challenges the incoming administration faces.
- The Safe Act would seem to be the most likely legislation to pass in the new Congress, potentially with some social equity component.

The Winners In Cannabis Will Need To Drive Scale Advantages

THE MARKET REWARDS SCALE, AND THE ABILITY TO CONVERT GROWTH TO PROFITS



Source: Cowen and Company



COWEN ANALYSTS

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REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES

CHARTING CANNABIS: A U.S. STATE-LEVEL DEEP DIVE

February 19, 2020

Cowen Analyst: Vivien Azer, Jaret Seiberg, Eric Assaraf, Gerald Pascarelli, CFA

THE NORTH AMERICAN CANNABIS LANDSCAPE

November 25, 2020

Cowen Analyst: Vivien Azer, Gerald Pascarelli, CFA

ASSESSING IMPACT ON FINANCIALS, HOUSING & CANNABIS AS ELECTION BECOMES CLEARER

November 5, 2020

Cowen Analyst: Jaret Seiberg

COWEN'S CANNABIS CATALYST SERIES – 8 PART SERIES

PART 1: UPCOMING BALLOT INITIATIVES

PART 2: KNOCK-ON EFFECTS: BALLOTS AND BUDGETS

PART 3: 280E IMPLICATIONS

PART 4: CBD IMPLICATIONS

PART 5: STATES ACT

PART 6: MORE ACT

PART 7: ALCOHOL IMPLICATIONS

PART 8: LAST MINUTE PREDICTIONS

September 10 – October 29, 2020

Cowen Analysts: Vivien Azer, Gerald Pascarelli, CFA, Eric Assaraf, Chris Krueger

CANNABINOIDS: WEEDING OUT THE COMPETITION

October 1, 2020

Cowen Analyst: Phil Nadeau, Ph.D.

U.S. CBD YEAR 2 - ASSESSING THE PUTS AND TAKES OF AN EMERGING CATEGORY

June 12, 2020

Cowen Analyst: Gerald Pascarelli, CFA, Vivien Azer

COWEN COMPANY COVERAGE

ACREAGE HOLDINGS **ACRG/B/U**

AURORA CANNABIS **ACB.TO**

CANOPY GROWTH CORPORATION **WEED**

CHARLOTTE'S WEB **CWBHF**

CRESCO LABS **CRLBF**

CURALEAF HOLDINGS **CURLF**

CV SCIENCES **CVSI**

GREEN THUMB INDUSTRIES **GTBIF**

GREENLANE HOLDINGS **GNLN**

KUSHCO HOLDINGS **KSHB**

MEDMEN ENTERPRISES **MMNFF**

NEPTUNE WELLNESS SOLUTIONS **NEPT.TO**

SUNDIAL GROWERS **SNDL**

THE CRONOS GROUP **CRON.CN**

TILRAY **TLRY**

SELECTED EVENTS

2020 BOSTON CANNABIS CONFERENCE

November 30 – December 2, 2020

COWEN'S ELECTION CONFERENCE CALL SERIES

Various dates before and after the November election

CANNABIS POLICY SUMMIT

July 16, 2020

40TH ANNUAL HEALTH CARE CONFERENCE

March 2-4, 2020

LIQUID BIOPSY

Liquid biopsy has the potential to revolutionize the cancer diagnosis and treatment market. Beyond clinical applications, liquid biopsies are already providing important information as part of drug development efforts. We believe liquid biopsy will be one of the most important growth areas in diagnostic tools in the coming decade.

 [WATCH VIDEO](#) DOUG SCHENKEL



 **WHAT WE'RE WATCHING**

- Clinical data and validations
- Reimbursement progress
- Biopharma partnership agreements
- Progress of recent/pending commercial launches in asymptomatic screening and recurrence monitoring

 **RELATED THEMES**

- Targeted therapy

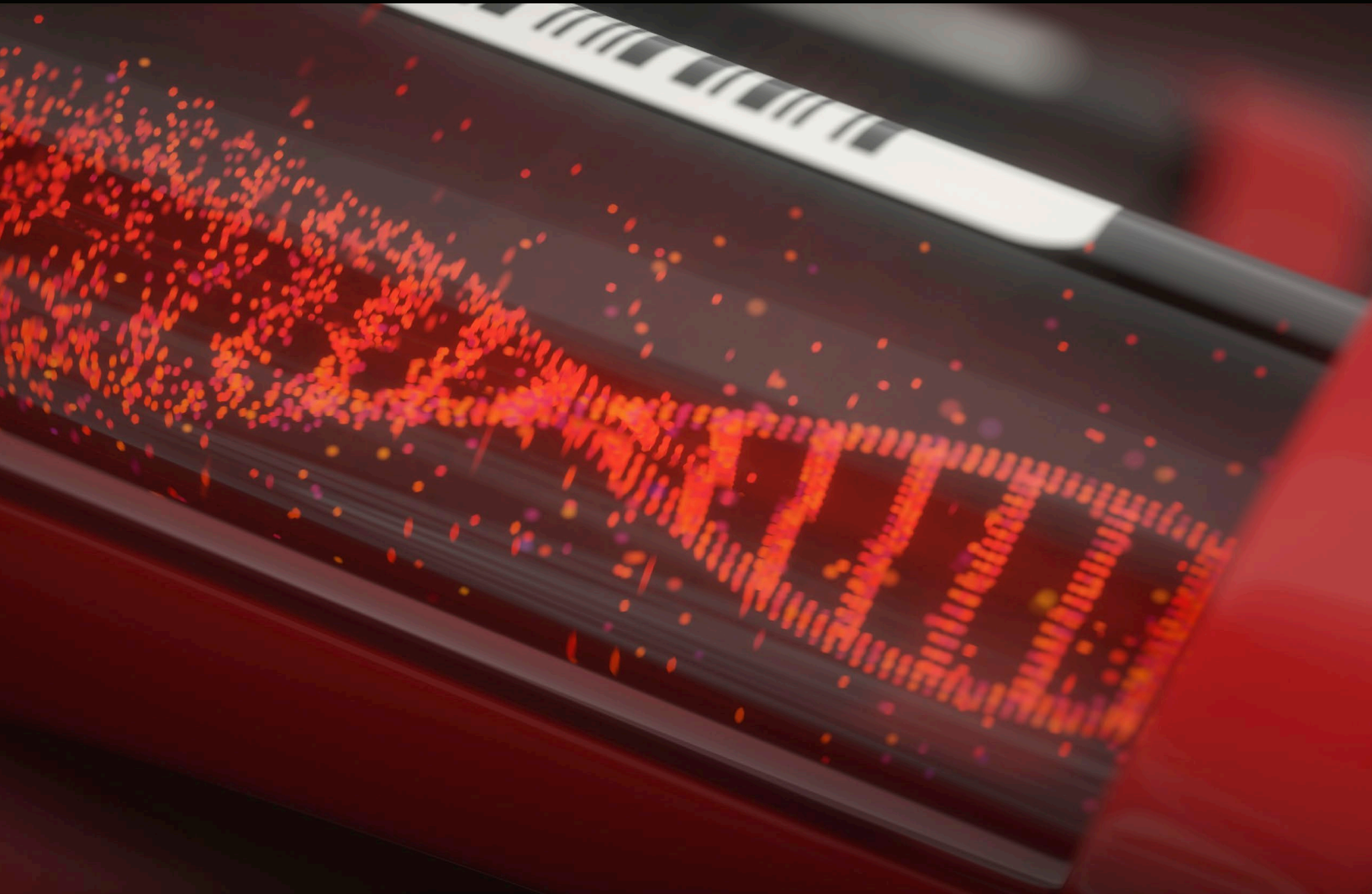


15M

CANCER SURVIVORS IN THE U.S.

> 300M

PEOPLE IN THE U.S. THAT COULD
BENEFIT FROM EARLY CANCER
SCREENING TOOLS



1.8M

NEW CANCER DIAGNOSES
IN THE U.S. IN 2020

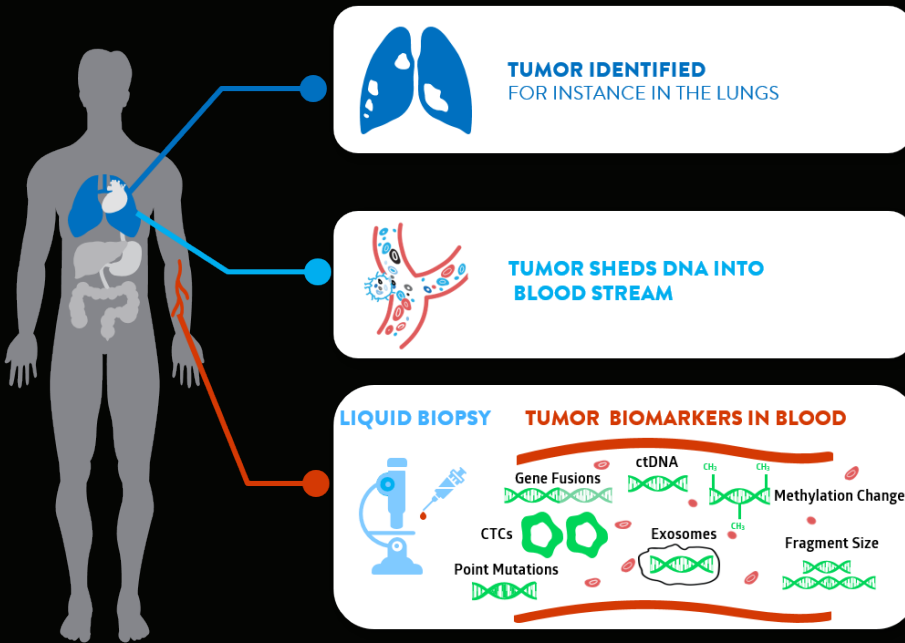
< 5%

ESTIMATED CURRENT PENETRATION
OF PATIENTS ELIGIBLE TO USE LIQUID
BIOPSY TOOLS AS A CANCER
COMPANION DIAGNOSTIC



Liquid Biopsy, A Diagnostic Test That Uses A Blood Draw To Identify Genetic Signatures Associated With Cancer, Could Be A Game-Changer

ANALYTES & BIOMARKERS USED FOR LIQUID BIOPSY TESTS



Advantages Of Using Liquid Biopsies:

- Non-invasive
- Inexpensive
- Not tissue dependent
- Enables serial monitoring
- Rapid turnaround
- Precise and comprehensive
- Ease of use/better outcomes

Source: Cowen and Company

The Liquid Biopsy Market Is Large, Promising, And Underpenetrated

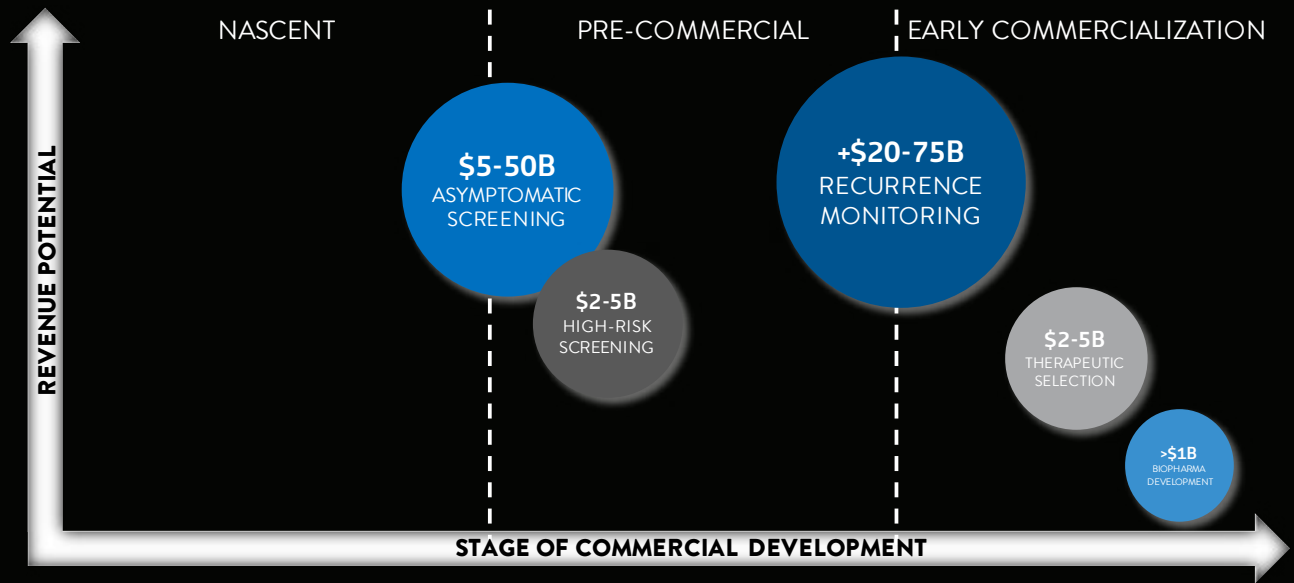
- Large Market Opportunity
- Product Concepts Have Become Reality As Reimbursement/Regulatory Pathways Improve
- The Market Is At An Early Stage Relative To Its Potential
- Notable Progress Has Led To Myriad Opportunities To Invest In Liquid Biopsy

Source: Cowen and Company



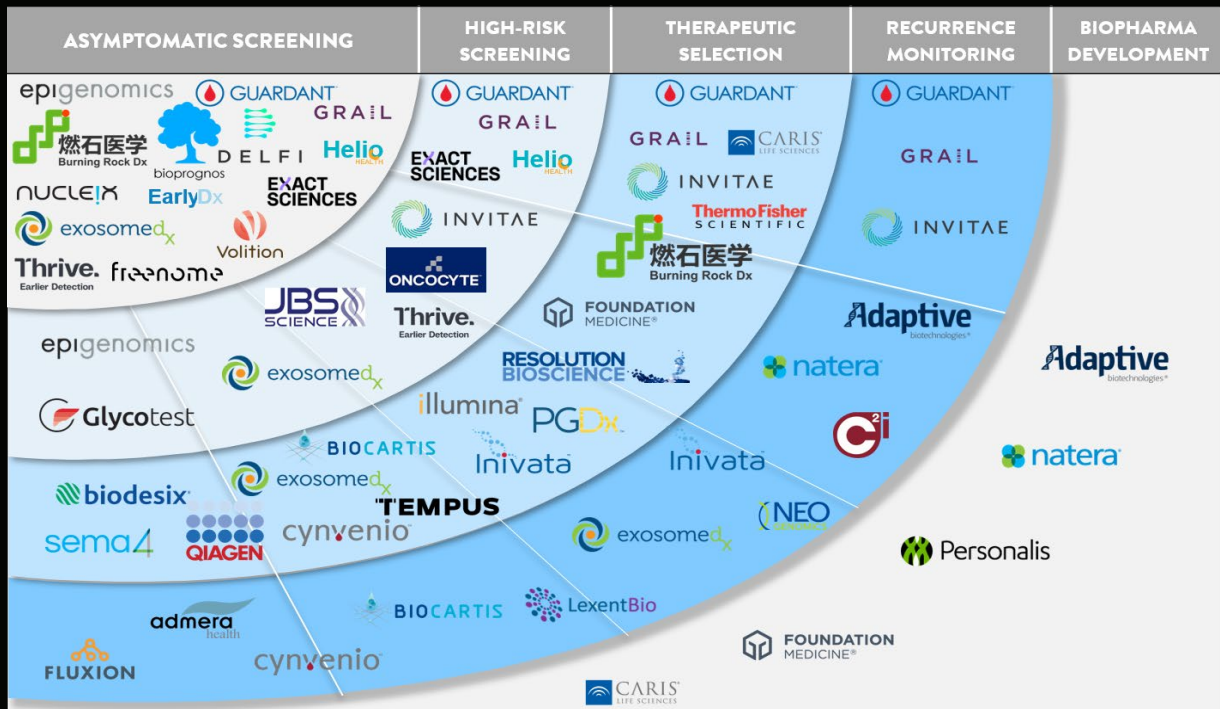
The Total Addressable Market Is \$30-\$130 Billion In The U.S. Alone

U.S. LIQUID BIOPSY TOTAL ADDRESSABLE MARKET BY SUB-SEGMENT VS. MARKET MATURITY



Source: Cowen and Company

100+ Companies Are Developing Or Commercializing Liquid Biopsy Products



Source: Cowen and Company



Regulatory And Reimbursement Pathways Are Improving



REGULATION

- Initial commercial biopsy tools have largely been launched without FDA approval and processed in centralized labs under the lab-developed test (“LDT”) pathway.
- Increasingly, companies like Guardant and Foundation Medicine (Roche) have successfully garnered FDA approval for their therapeutic decision-making tools., helping with reimbursement, adoption, and partnerships.
- FDA approval/clearance is required for kit-based liquid biopsy tests.
- The biggest regulatory “grey area” currently appears to be how the FDA will treat asymptomatic cancer screening tests.
- Practically speaking, FDA approval is (at a minimum) very important to driving reimbursement – both from CMS (the biggest payer given many people targeted are Medicare covered) and commercial payers.



REIMBURSEMENT

- The path to Medicare reimbursement is quite important to most liquid biopsy products given the demographics of the target market.
- Non-screening tests can be launched without FDA approval and can then plausibly be reimbursed either via a CMS local or national coverage decision.
- Notably, Medicare does not generally cover screening tests. CMS typically considers screening tests preventive services, and accordingly will only reimburse in the absence of signs/ symptoms of illness/injury if there is a statutory provision that authorizes (or does not prevent) coverage.
- The clearest path to CMS reimbursement today for a screening test is to obtain FDA authorization, and then obtain a grade of A or B from USPSTF, to enable CMS to issue a national coverage decision (NCD).

“The liquid biopsy market has changed drastically since our initial Liquid Biopsy Primer, which we published over five years ago. Companies in the space have made demonstrable progress with their tests.”

— DOUG SCHENKEL

AHEAD OF THE CURVE® SERIES

The Liquid Biopsy Primer: Early Detection Of A Huge Opportunity



COWEN ANALYSTS

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CHRIS LIN, CFA

REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES

THE LIQUID BIOPSY PRIMER: EARLY DETECTION OF A HUGE OPPORTUNITY

September 18, 2020

Cowen Analyst: Doug Schenkel

KEY OBSERVATIONS FROM THE 2020 COWEN LIQUID BIOPSY SUMMIT

September 28, 2020

Cowen Analyst: Doug Schenkel

KEY OBSERVATIONS FROM Q&A SESSION ON GRAIL WITH ILMN'S CEO

September 24, 2020

Cowen Analyst: Doug Schenkel

FDA APPROVES G360 FOR COMPREHENSIVE GENETIC PROFILING OF ALL SOLID TUMORS

August 9, 2020

Cowen Analyst: Doug Schenkel

BURNING ROCK INITIATION: UNIQUE CHANCE TO GLOBALIZE HIGH-GROWTH/QUALITY CANCERDX PORTFOLIO

July 7, 2020

Cowen Analyst: Doug Schenkel

PERSONALIS: KEY TAKEAWAYS FROM MEETINGS WITH MANAGEMENT

February 24, 2020

Cowen Analyst: Doug Schenkel

2020 AACR ADVANCES IN LIQUID BIOPSIES MEETING: KEY OBSERVATIONS

January 23, 2020

Cowen Analyst: Doug Schenkel

COWEN COMPANY COVERAGE

ADAPTIVE BIOTECHNOLOGIES **ADPT**

BURNING ROCK BIOTECH LTD **BNR**

EXACT SCIENCES **EXAS**

GUARDANT HEALTH **GH**

ILLUMINA **ILMN**

INVITAE **NVTA**

NATERA **NTRA**

PERSONALIS **PSNL**

QIAGEN **QGEN**

ROCHE **RHHBY**

THERMO FISHER SCIENTIFIC **TMO**

TWIST BIOSCIENCE **TWST**

SELECTED EVENTS

8TH ANNUAL MEDTOOLS CONFERENCE

October 15, 2020

23RD ANNUAL THERAPEUTICS CONFERENCE

October 13-14, 2020

LIQUID BIOPSY SUMMIT

September 24, 2020

4TH ANNUAL FUTUREHEALTH CONFERENCE

June 24-25, 2020

40TH ANNUAL HEALTH CARE CONFERENCE

March 2-4, 2020

TARGETED THERAPIES

We expect continued focus on targeted therapies in 2021, fueled by significant worldwide market opportunities and promising data in 2020 across a range of targets and diseases. As tumor genomic profiling becomes increasingly prevalent and enhances understanding of the mutations driving certain cancers and rare disease, more companies are focusing on investment in precision medicines as a key pillar of their strategies, suggesting continued M&A.

 **WATCH VIDEO** PHIL NADEAU, PH.D.



WHAT WE'RE WATCHING

- MRTX Adagrasib NDA filing for accelerated approval mid/2H21
- RLAY 1971 SHP2i data 2H21
- Sotorasib approval YE21
- IASLC 2021 World Conference on Lung Cancer
- ASCO 2021
- Trodelvy Ph. III Interim in ER+ HER2- mBC (H1:21)

RELATED THEMES

- Liquid biopsy



“Targeted therapies are changing the landscape of cancer treatment and likely will be used in most cancer patients in 5-10 years.”

— **COWEN’S THERAPEUTIC CATEGORIES OUTLOOK**

October 2020



\$220B

WORLDWIDE MARKET FOR TARGETED
ANTI-CANCER THERAPIES IN 2025

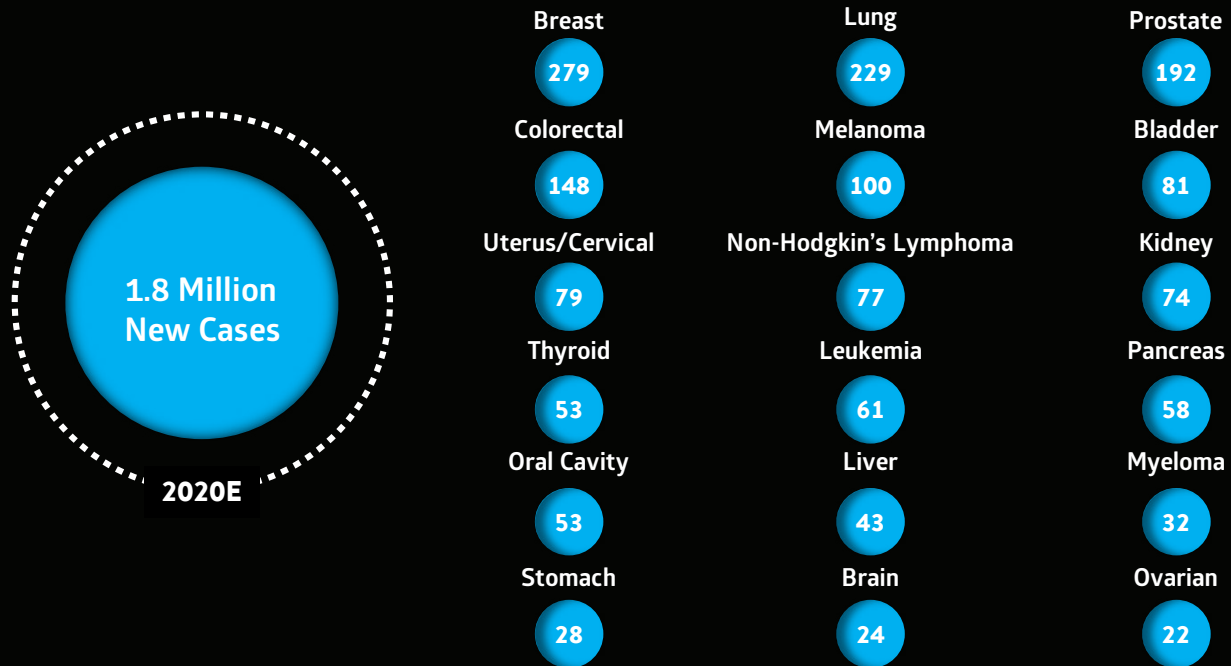
50%

OF NON-SMALL CELL LUNG CANCER
PATIENTS RECEIVE NEXT GENERATION
SEQUENCING (NGS) IN COURSE OF
TREATMENT



Cancer Is The #2 Cause Of Death In The U.S. (After Heart Disease), With ~607,000 Deaths And 1.8 Million New Cases Expected In 2020

MOST COMMON FORMS OF CANCER IN U.S. IN 2020, NEW CASES IN THOUSANDS



Source: The American Cancer Society and Cowen and Company

Cancer Is The Largest Global Pharmaceutical Therapeutic Category At \$148B In 2019 And Targeted Therapies Are Changing The Landscape Of Cancer Treatment

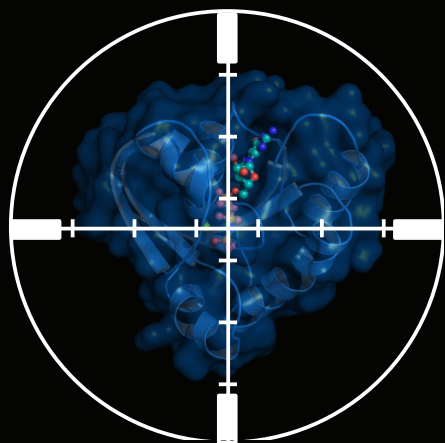
TARGETED THERAPIES ARE MOLECULARLY TARGETED DRUGS THAT BLOCK GROWTH-SIGNALING PATHWAYS OR DELIVER TOXIC PAYLOADS

- Will be used in most cancer patients in 5-10 years.
- Emerging immuno-oncology agents such as checkpoint inhibitors are expected to see robust growth over the next five years.
- Engineered cell therapies hold much promise as the next-generation cancer treatments and saw initial approvals in 2017. We project ~\$50B in WW sales in 2025 for the PD-(L)1 class.
- Monoclonal antibodies, oral tyrosine kinase inhibitors will likely remain mainstays.



Targeting The RAS Oncogene Has Been Fiercely Pursued For Decades. However, New Strategies Have Recently Emerged With The Potential For Therapeutic Efficacy.

RAS, “THE BEATING HEART” OF CANCER



TARGETED THERAPY AGENTS: TYPES, ACTION, USES

Type/Drug Class	Mechanism of Action	Uses
Angiogenesis Inhibitors	Block formation of new blood vessels	Colorectal, breast, lung, RCC and brain cancer
Small Molecule Kinase Inhibitors	Inhibit growth factor receptors, intracellular enzyme activity	CML, NSCLC, RCC, HCC, BC, OC
Monoclonal Antibodies	Block interactions of cell-surface receptors with their ligands	Her2+ BRCA, NHL, CLL, CRCA, NSCLC, and numerous R&D
Antibody-Drug Conjugates	Use antibody specificity to deliver toxic payloads to tumor cells	HL, BRCA, ALL and AML, TNBC

Source: Cowen and Company

Oncology Continues To Benefit From An Expedited Review Process At The FDA

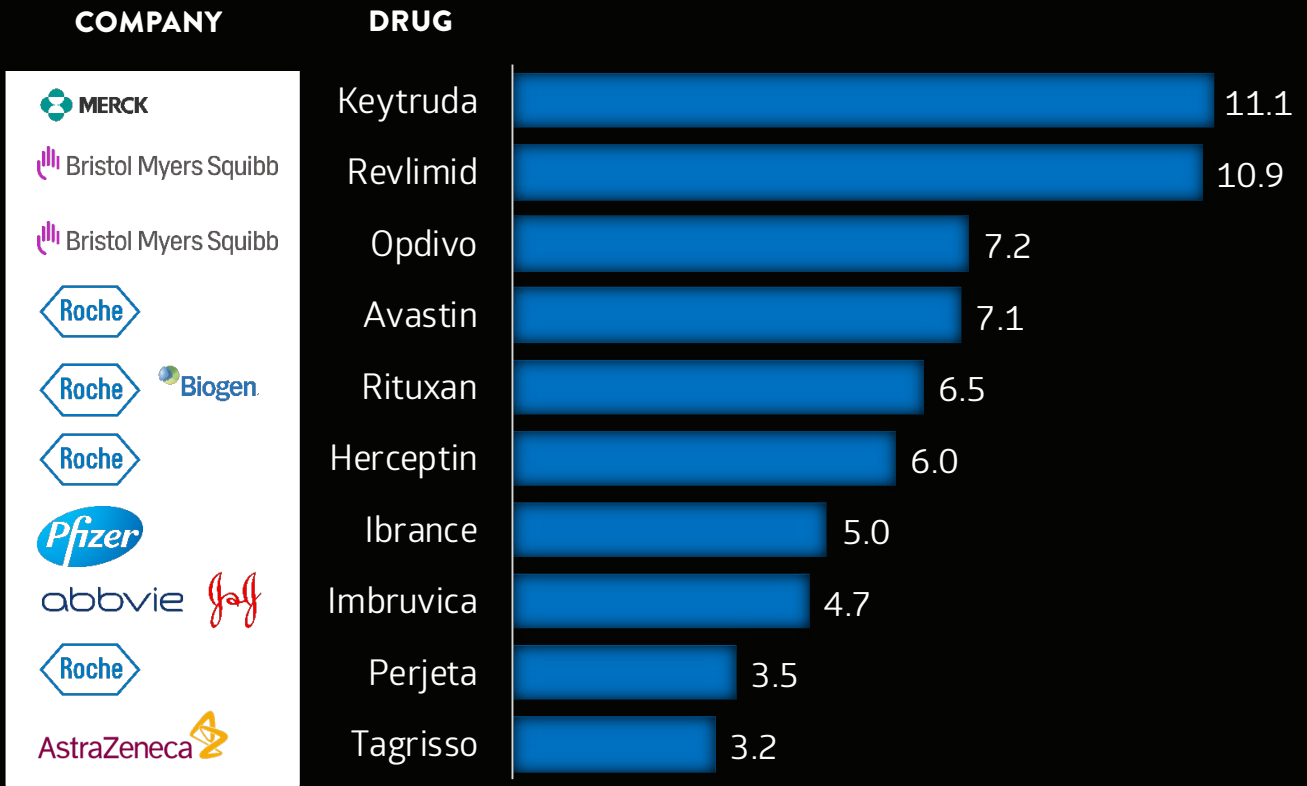
PROGRAM	ATTRIBUTES
FAST TRACK	<ul style="list-style-type: none"> Designed to facilitate drug development and expedite the review of drugs to treat serious conditions and fill an unmet medical need. Provisions include the ability to submit NDA data on a rolling basis and the ability of many cancer drugs to qualify for Priority Review.
BREAKTHROUGH THERAPY	<ul style="list-style-type: none"> Introduced in 2012, includes all the Fast Track benefits, as well as intensive FDA advice and communication on the optimal path through development.
ACCELERATED APPROVAL	<ul style="list-style-type: none"> These regulations allow for drugs for serious conditions that fill an unmet medical need to be approved based on a single pivotal trial.
PRIORITY REVIEW	<ul style="list-style-type: none"> Priority Review designation means that the FDA's goal is to take action on an application within 6 months.
REAL-TIME ONCOLOGY REVIEW PILOT PROGRAM	<ul style="list-style-type: none"> Launched in July 2018, Real-Time Oncology Review (RTOR) pilot program is designed to expedite the approval process for oncology assets. RTOR allows the FDA to review a portion of the clinical data earlier, before the applicant formally submits the complete application.

Source: FDA, Cowen and Company



Big Pharma's Drugs Lead The Category A Wave Of New Innovators Will Try To Change This

TOP 10 ONCOLOGY DRUGS BY 2019 WORLDWIDE SALES EXCLUSIVE OF SUPPORTIVE CARE AGENTS, \$ IN BILLIONS



Source: Cowen and Company

“The next wave of targeted therapies is represented by increasingly selective agents directed at other driver mutations (e.g. KRAS). Success is dependent on increased testing rates.”

— COWEN’S THERAPEUTIC CATEGORIES OUTLOOK
October 2020



COWEN ANALYSTS

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REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES

THE ABCS OF ADCS: INVESTOR PRIMER ON ANTIBODY DRUG CONJUGATES - AHEAD OF CURVE

December 4, 2020

Cowen Analyst: Boris Peaker, Ph.D., CFA

23RD ANNUAL THERAPEUTICS CONFERENCE TOPICAL PANEL WRAP-UP

October 2020

Cowen Analysts: Cowen Health Care Team

COWEN'S THERAPEUTIC CATEGORIES OUTLOOK

October 2, 2020

February 26, 2020

Cowen Analysts: Cowen Health Care Team

COWEN'S BIOTECHNOLOGY QUARTERLY

October 1, 2020

February 24, 2020

Cowen Analysts: Cowen Health Care Team

FOGHORN THERAPEUTICS: INITIATING WITH OUTPERFORM. BAFFLINGLY INNOVATIVE IN HIGHLY UNIQUE WAYS

November 17, 2020

Cowen Analyst: Yaron Werber, M.D.

PMV PHARMACEUTICALS: INITIATING WITH OUTPERFORM - GUARDIAN OF THE P53 GALAXY

October 20, 2020

Cowen Analyst: Yaron Werber, M.D.

MIRATI THERAPEUTICS: KRAS CONTINUES TO COMPEL

October 1, 2020

Cowen Analyst: Yaron Werber, M.D.

BEST SMIDCAP IDEAS: IMMU - TRODELVY IS NOT DONE CREATING SHAREHOLDER VALUE

June 12, 2020

Cowen Analyst: Phil Nadeau, Ph.D.

BLACK DIAMOND THERAPEUTICS: INITIATING COVERAGE: NAVIGATING THE MOGULS OF TARGETED THERAPY

February 24, 2020

Cowen Analyst: Marc Frahm, Ph.D.

COWEN COMPANY COVERAGE

ABBVIE **ABBV**

AGIOS PHARMACEUTICALS

AGIO

AMGEN **AMGN**

ASTRAZENECA PLC (ADR) **AZN**

BAVARIAN NORDIC **BAVA.DC**

BEIGENE **BGNE**

BLACK DIAMOND

THERAPEUTICS **BDTX**

BLUEBIRD BIO **BLUE**

BLUEPRINT MEDICINES **BPMC**

BRISTOL-MYERS SQUIBB **BMY**

CYTOMX THERAPEUTICS **CTMX**

ELI LILLY **LLY**

EPIZYME **EPZM**

EXELIXIS **EXEL**

FIVE PRIME THERAPEUTICS

FPRX

FOGHORN THERAPEUTICS

FHTX

G1 THERAPEUTICS **GTHX**

GLAXOSMITHKLINE PLC

(ADR) **GSK**

IMMUNOGEN **IMGN**

INCYTE **INCY**

JOHNSON & JOHNSON **JNJ**

JOUNCE THERAPEUTICS **JNCE**

KURA ONCOLOGY **KURA**

MACROGENICS **MGNX**

MERCK **MRK**

MERSANA THERAPEUTICS **MRSN**

MIRATI THERAPEUTICS **MRTX**

NEKTAR THERAPEUTICS **NKTR**

NOVARTIS (ADR) **NVS**

PFIZER **PFE**

PIERIS PHARMACEUTICALS **PIRS**

PMV PHARMACEUTICALS **PMVP**

PUMA BIOTECHNOLOGY **PBYI**

REGENERON

PHARMACEUTICALS **REGN**

RELAY THERAPEUTICS **RLAY**

REVOLUTION MEDICINES **RVMD**

ROCHE HOLDING LTD (ADR)

RHHBY

SANOFI (ADR) **SNY**

SEAGEN **SGEN**

SPRINGWORKS THERAPEUTICS

SWTX

SURFACE ONCOLOGY **SURF**

SUTRO BIOPHARMA **STRO**

SYNDAX PHARMACEUTICALS

SNDX

SYROS PHARMACEUTICALS **SYRS**

TAKEDA PHARMACEUTICAL **TAK**

UNITED THERAPEUTICS **UTHR**

X4 PHARMACEUTICALS **XFOR**

Y-MABS THERAPEUTICS **YMAB**

SELECTED EVENTS

IO NEXT SUMMIT

November 13, 2020

23RD ANNUAL THERAPEUTICS CONFERENCE

October 13-14, 2020

HOT WHEELS

August 5-7, 2020

VIRTUAL ONCOLOGY INNOVATION SUMMIT

May 15, 2020

COWEN ASCO KOL SERIES:

IMMUNE ONCOLOGY AND TARGETED THERAPIES

May 14, 2020

Conference Call

40TH ANNUAL HEALTH CARE CONFERENCE

March 2-4, 2020

Boston, MA

COOL WHEELS

Targeted Therapies, Dana

Farber Cancer Institute

January 21, 2020

Boston, MA

CENTRAL NERVOUS SYSTEM

CNS remains among the most active and challenging realms of drug development, focused on significant and growing market opportunities in categories as diverse as Treatment-Resistant Depression and Alzheimer's Disease. In 2021, we expect data readouts in novel areas such as psilocybin therapeutics and closely watched trials involving anti-amyloid, anti-tau and immune-modulatory therapeutics.

 **WATCH VIDEO** RITU BARAL



WHAT WE'RE WATCHING

- 6 Alzheimer's Disease (AD) trial readouts in 1H21
- The FDA decision on potential approval for aducanumab for Alzheimer's (1Q21)
- Anti-Tau data
- COMP360 / Psilocybin 2H21 data in Treatment-Resistant Depression (TRD)
- April 3, 2021 PDUFA for ACAD's pimavanserin in DRP
- Ph2 POC data for SRPT's Phase 2 Gene Therapy for DMD in 1Q21
- Ph3 MDD WATERFALL Data for SAGE's zuranolone in 1H21



“One of the most exciting therapeutic avenues being explored is the direct targeting of the genetic underpinnings of certain forms of AD, such as ApoE4 and APP.”

— **STEVE SCALA, R.PH., CFA**

Alzheimer's Disease KOL Call Highlights, November 10, 2020



1 in 4

AMERICANS
SUFFER FROM A
DIAGNOSABLE
MENTAL DISORDER

264M

ESTIMATED PEOPLE
WORLDWIDE
SUFFER FROM
DEPRESSION

30-44%

ESTIMATED TREATMENT-
RESISTANT PATIENTS WITH
MAJOR DEPRESSIVE
DISORDER (MDD)



Investor Focus Is On Three Key Areas For 2021 And Beyond

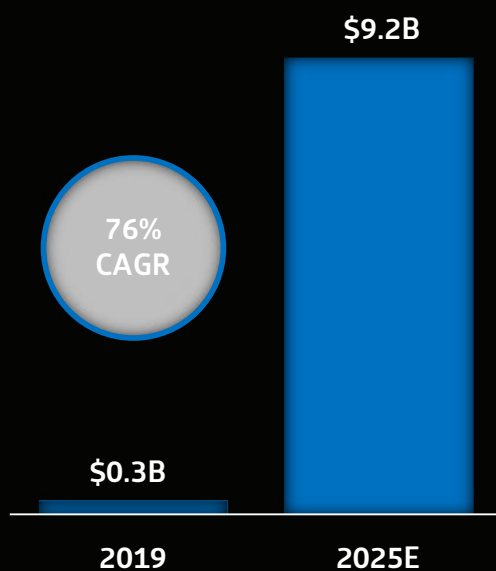


- 1 Potential new therapies in Alzheimer's
- 2 Novel agents in neuropsychiatry that are stronger than earlier generations of therapy
- 3 Multiple potential gene therapies for Duchenne's Muscular Dystrophy, representing a new frontier in neuro gene therapies

Source: Cowen and Company

In The Alzheimer's Category, We Forecast Significant Growth In Branded Drug Sales

ALZHEIMER'S DISEASE GLOBAL BRANDED DRUG SALES



WHAT'S NEXT FOR AD DRUGS?

The Peripheral and Central Nervous System Drugs Advisory Committee recently provided a strong rebuke to aducanumab's data.

While FDA approval of aducanumab is still possible, it is unlikely.

Pharma has a broad pipeline of AD drugs across mechanisms. In H1:21, there could be 6 readouts of AD trials.

Directly targeting the genetic underpinnings of AD through novel approaches such as antisense and CRISPR.

Source: Cowen and Company



New Classes Of Depression Treatments Are Moving Through Clinical Trials That Have More Powerful Mechanisms Of Action

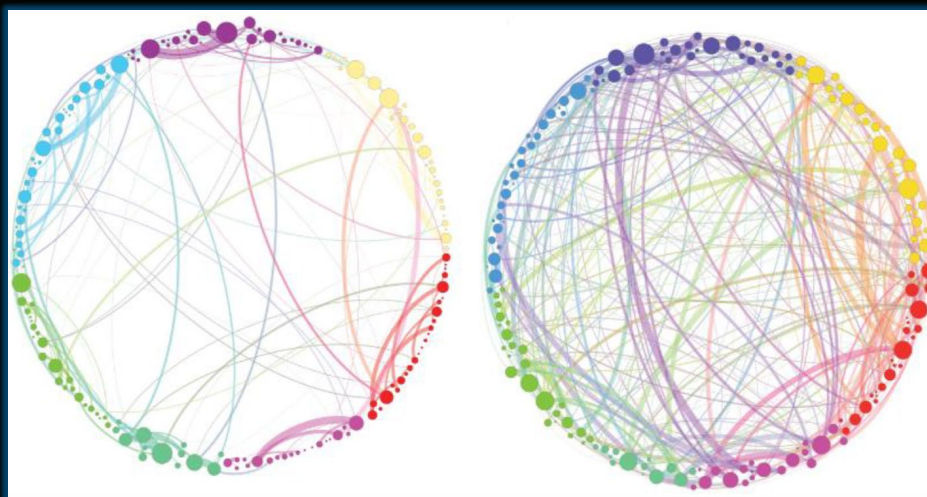
- The standard of care for major depressive disorder has, for years, consisted of therapies with very modest, slow-onset benefit, benign safety profiles, and widespread tolerability issues.
- New classes of more powerful therapies are moving through clinical trials.



Source: Cowen and Company

Psilocybin, A Psychoactive Substance, Has The Potential To Transform Outcomes For Patients With Treatment-Resistant Depression (“TRD”)

ACUTE CHANGES IN BRAIN NETWORK CONNECTIVITY



Placebo

Psilocybin

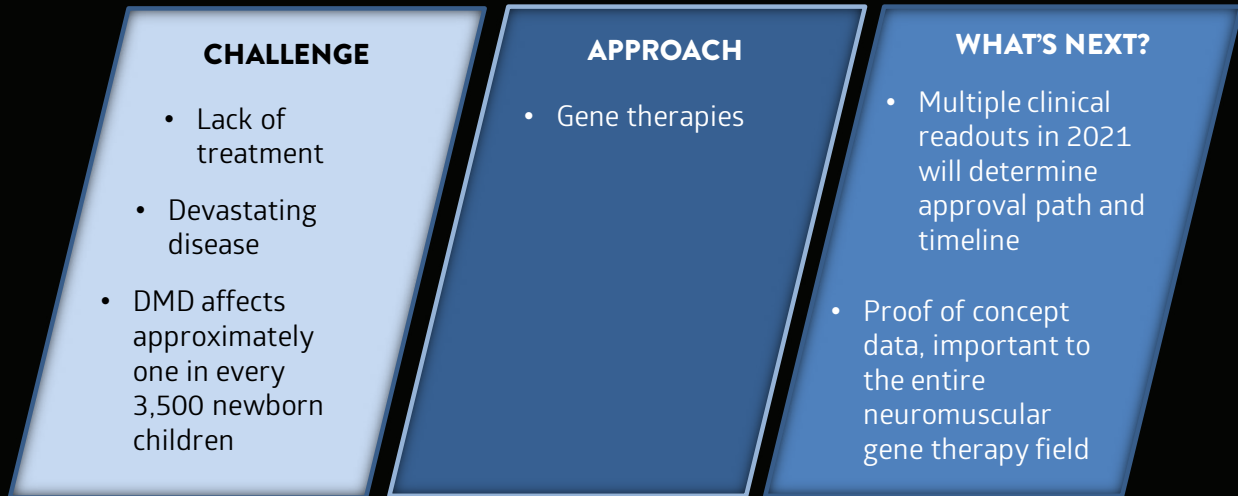
COMP360's Phase 2b data due in 2H21 will give critical proof of concept to the entire field and frame the market opportunity for psychedelic therapies.

Source: Compass Pathways



Another Key Investor Focus Is The Two Late Stage Gene Therapies In Development For Duchenne’s Muscular Dystrophy, A Rare Neuromuscular Disorder

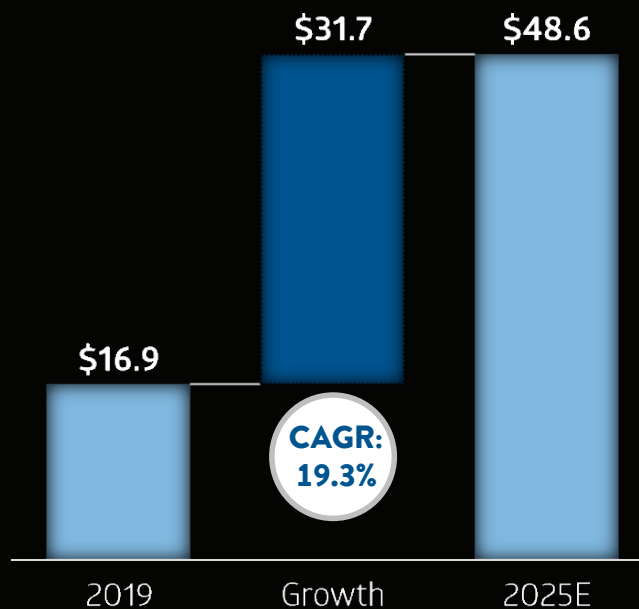
DUCHENNE’S MUSCULAR DYSTROPHY DRUG DEVELOPMENT



Source: Cowen and Company

We Forecast The CNS Drug Category To Triple In Size By 2025

CNS CATEGORY GLOBAL BRANDED DRUG, \$ IN BILLIONS



Source: Cowen and Company



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REPRESENTATIVE RESEARCH

AXSOME THERAPEUTICS: BEST IDEAS FOR 2021: AXS-05 LEADS AN UNDERAPPRECIATED LATE-STAGE PIPELINE

December 10, 2020

Cowen Analyst: Joseph Thome, Ph.D.

BIOGEN DOWNGRADE: ADCOM VOTES MAKE ADUCANUMAB'S APPROVAL UNLIKELY, P.T. TO \$215

November 10, 2020

Cowen Analyst: Phil Nadeau, Ph.D.

ALZHEIMER'S DISEASE KOL CALL HIGHLIGHTS

November 10, 2020

Cowen Analyst: Steve Scala, R.Ph., CFA, Phil Nadeau, Ph.D.

WHAT'S NEXT FOR ALZHEIMER'S DRUGS IN PHARMA? UP TO SIX TRIAL READOUTS IN 1H:21

November 9, 2020

Cowen Analyst: Steve Scala, R.Ph., CFA

COMPASS PATHWAYS: INITIATION: NAVIGATING THE CUTTING EDGE OF DEPRESSION THERAPEUTICS

October 13, 2020

Cowen Analyst: Ritu Baral

COWEN THERAPEUTIC CATEGORIES OUTLOOK

October 2, 2020

February 26, 2020

Cowen Analysts: Cowen Health Care Team

HIGHLIGHTS FROM VIRTUAL COMPANY MEETINGS

August 9, 2020

Cowen Analysts: Steve Scala, R.Ph., CFA, Marc Frahm, Ph.D.

BIOHAVEN PHARMACEUTICAL HOLDING COMPANY LTD

April 17, 2020

Cowen Analyst: Ken Cacciatore

COWEN COMPANY COVERAGE

ABBVIE **ABBV**
 ACADIA PHARMACEUTICALS **ACAD**
 ACORDA THERAPEUTICS **ACOR**
 ADAMAS PHARMACEUTICALS **ADMS**
 ALECTOR **ALEC**
 ALNYLAM PHARMACEUTICALS **ALNY**
 AMGEN **AMGN**
 AMICUS THERAPEUTICS **FOLD**
 ASTRAZENECA **AZN**
 APTINYX **APTIX**
 AVIDITY BIOSCIENCES **RNA**
 AVROBIO **AVRO**
 AXSOME THERAPEUTICS **AXSM**
 BAUSCH HEALTH COMPANIES **BHC**
 BIOGEN **BIIB**
 BIOHAVEN PHARMACEUTICALS **BHVN**
 BRISTOL MYERS SQUIBB **BMS**
 COMPASS PATHWAYS **CMPS**
 ELI LILLY **LLY**
 EMERGENT BIOSOLUTIONS **EBS**
 GENERATION BIO **GBIO**
 GLAXOSMITHKLINE **GSK**
 GW PHARMACEUTICALS **GWPH**
 HERON **HRTX**
 IONIS PHARMACEUTICALS **IONS**
 JAZZ PHARMACEUTICALS **JAZZ**
 JOHNSON & JOHNSON **JNJ**
 MARINUS PHARMACEUTICALS **MRNS**
 MERCK **MRK**
 NEOS THERAPEUTICS **NEOS**
 NEUROCRINE BIOSCIENCES **NBIX**
 NOVARTIS (ADR) **NVS**
 NOVO NORDISK (ADR) **NVO**
 ORCHARD THERAPEUTICS **ORTX**
 OVID THERAPEUTICS **OVID**
 PASSAGE BIO **PASG**
 PFIZER **PFE**
 PRAXIS PRECISION MEDICINES **PRAX**
 PREVAIL THERAPEUTICS **PRVL**
 PTC THERAPEUTICS **PTCT**
 REGENERON PHARMACEUTICALS **REGN**
 ROCHE HOLDING LTD (ADR) **RHHBY**
 SAGE THERAPEUTICS **SAGE**
 SAREPTA THERAPEUTICS **SRPT**
 SUPERNUS PHARMACEUTICALS **SUPN**
 STOKE THERAPEUTICS **STOK**
 TAKEDA PHARMACEUTICAL COMPANY **TAK**
 TEVA PHARMACEUTICAL **TEVA**
 VOYAGER THERAPEUTICS **VYGR**

SELECTED EVENTS

23RD ANNUAL THERAPEUTICS CONFERENCE

October 13-14, 2020

HOT WHEELS

August 5-7, 2020

40TH ANNUAL HEALTH CARE CONFERENCE

March 2-4, 2020
Boston, MA

ELECTION 2020

The ultimate arbiter for policy next year will be not just the Senate majority, but the margin. With the presidential transition of power to Joseph Biden now underway, our focus turns to the Georgia Senate runoffs slated for January 5th. Democratic control of the Senate given the tie-breaking vote of VP Harris is possible. 50 Democratic senators could use reconciliation to pass party-line votes on revenue measures (taxes & fiscal), but cannot do things like increase Supreme Court, most labor policies, or add PR/DC as states without eliminating filibuster. January 5th will be key to understanding what could happen in 2021 and beyond.

 **WATCH VIDEO** CHRIS KRUEGER



WHAT WE'RE WATCHING

- Senate runoffs
- Transition roadblocks
- Health care
- U.S. emissions policy
- China relations
- Big tech regulation
- Tax plans

RELATED THEMES

- U.S./China competition & decoupling
- Big tech & government
- ESG and energy transition
- Cannabis



“Regardless of the election outcome, we expect fiscal policy to remain near an 11 and infrastructure to finally get over the goal line in 2021.”

— **AHEAD OF THE CURVE® SERIES**
THE HUNT FOR DREAD OCTOBER: 2021 POLICY IMPACTS



“Congress may be moving slower than the cannabis industry would like, but it is moving faster than almost any other policy issue.”

— **JARET SEIBERG**

Cannabis Policy: What To Watch When House Votes On More Act

“When D.C. is on the edge of a policy cliff, it generally builds more land. But the Thelma & Louise finish is entirely possible.”

— **CHRIS KRUEGER**

A Long December: Lame Duck Flying Into Fiscal Cliff Under Georgia Shadow



Biden's Plan Calls For New Spending On Infrastructure, R&D, And Education Funded By Individual & Corporate Tax Increases

SPENDING AND REVENUE UNDER BIDEN PLAN, 2021–2030

PROPOSED NEW SPENDING **\$5.4 TRILLION**

Infrastructure and R&D \$1.6 trillion	Housing \$650 billion
Education \$1.9 trillion	Paid leave \$527 billion
	Social Security
	Health Care

PROPOSED NEW REVENUE **\$3.4 TRILLION**

Individual income tax \$944 billion	Corporate tax \$1.4 trillion
Payroll tax \$993 billion	

Source: Penn Wharton Budget Model, Cowen and Company

However, Without A Majority In The Senate, President Biden Would Not Be Able To Raise Taxes In Line With His \$4T Plan

BIDEN CORPORATE TAX PLAN

\$770B	
INCREASE CORPORATE TAX RATE TO 28%	
\$318B	\$303B
15% MIN TAX ON BOOK INCOME	21% GILTI TAX

BIDEN INDIVIDUAL TAX PLAN

\$808B	\$503B
12.4% SOCIAL SECURITY PAYROLL TAX ON INCOME >\$400K	TAX CAP GAINS & DIVIDENDS AT 39.6% & ELIMINATE "STEP UP"
\$56B	\$151B
CAP ITEMIZED DEDUCTIONS AT 28%	INCREASE TOP INDIVIDUAL TAX RATE TO 39.6%

*all costs are over 10 years and "best guesses"
Source: CBO, Tax Foundation & Cowen and Company



The Goal Of Biden's \$2T Energy And Infrastructure Plan Is To Transition The U.S. To 100% Clean Energy By 2035

THE KEY ELEMENTS OF THE \$2T BIDEN INFRASTRUCTURE/ENERGY PLAN

BUILD A MODERN INFRASTRUCTURE	<ul style="list-style-type: none"> • Roads • Bridges • Green Spaces • Water Systems • Electricity Grids • Universal Broadband • Spark "2nd Great Railroad Revolution" • 100K+ Resident Cities Get Zero-Emission Buses By 2030
AUTOS	<ul style="list-style-type: none"> • Clean Cars For America Bill • Cash For Clunkers 2.0 • 500K EV Charging Stations • Accelerate Battery Research • Convert All 500K School Buses To Zero Emissions
CARBON POLLUTION-FREE POWER SECTOR BY 2035	<ul style="list-style-type: none"> • Extend Clean Energy Tax Incentives • Establish Energy Efficient & Clean Electricity Standard For Utilities
ENERGY EFFICIENCY IN BUILDINGS	<ul style="list-style-type: none"> • 4M Retrofits • Weatherize 2M • Build 1.5M New Affordable Homes, Cash Rebates And Low-Cost Financing To Upgrade Energy Inefficient Appliances And Windows
CLEAN ENERGY INNOVATION	<p>This is basically the "Buy American" Plan from earlier in July</p> <p>\$400B/4 years in federal spend on U.S.-made products with a focus on clean vehicles & green energy generation; construction materials for infrastructure improvements, including steel/cement; critical medical supplies & drugs to replenish national stockpiles</p> <p>\$300B investment in U.S. research on tech ranging from "electric vehicle technology to lightweight materials to 5G and artificial intelligence — to unleash high-quality job creation in high-value manufacturing and technology"</p>

Source: Cowen and Company

The Four Main Areas Of The \$775B (Over 10 Years) Plan To Fund Universal Child Care And In-Home Elder Care (Offset With Doubling Capital Gains Tax & Ending Real-Estate Tax Incentives)



\$ to States



Expand child care for kids up to five years old, including universal preschool



Expand care options for elderly and disabled people



Improve caregiver pay

THE ABOVE MEASURES WILL NOT LIKELY ADVANCE SHOULD THE GOP WIN ONE OF THE GEORGIA RUNOFFS

Source: Cowen and Company



New Administration Policy Will Have A Significant Impact On Some Sectors

INDUSTRY	FEDERAL IMPLICATIONS
MACRO	<p>We count at least three key long-term currents within the Democratic Party that may have meaningful consequences for global investors given the Biden-Harris win.</p> <p>Income Inequality has become an overarching umbrella through which all other policies, notably tax, labor, tech, and trade are viewed.</p> <p>China Confrontation/Buy America has replaced globalization as a critical leg in the party's economic table (though not the way the Trump Administration has pursued it).</p> <p>Tech Lash. The 25-30 year bipartisan consensus that trade was good is collapsing - in the same way that the consensus that "tech" was good is also collapsing. Both of these trendlines are likely to continue regardless of who is President.</p>
HEALTH CARE	<p>Without the Senate, there is little Biden can do outside of drug pricing demos, which are a threat (like IPI).</p> <p>With the Senate, Biden will likely lead with expansion of the ACA, though a public option is unlikely with a narrow Senate majority. Drug pricing items may be payfors. Biden's more aggressive plans like limiting drug launch prices are unlikely.</p>
TMT	<p>Biden will likely facilitate a multi-pronged regulatory encroachment via regulation, antitrust lawsuits & legislation.</p> <p>For semis/semicaps, we anticipate Biden to continue to take swings at China via export controls, but in a more nuanced approach, compared to Trump.</p>
DEFENSE	<p>We see defense spending top-line ranges from flat (2% nominal growth) to down -5% to -8% (real). We think defense metrics hold up fine for at least the next 2 years.</p> <p>Significant Biden foreign policy changes: Europe/Asia allies, NATO & course changes with Russia, North Korea, Iran, Turkey & Saudi Arabia.</p>
CANNABIS	<p>Senate control matters more than the White House. Our view is that as long as Mitch McConnell is the Majority Leader then legalization legislation will not get a vote in the Senate. McConnell has been steadfast in his opposition and has given no signs that he would relent.</p>
FINANCIALS	<p>Biden means tougher regulatory regime & higher taxes. But we expect a more stable macro environment with fewer trade fights, less use of tariffs and a more independent Fed.</p> <p>In general, we think banks will fare better under Biden given macro positives while many other financial firms will struggle more given regulatory positives.</p>

Source: Cowen and Company



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PAUL GALLANT

RICK WEISSENSTEIN
ERIC ASSARAF
ROMAN SCHWEIZER

REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES

THE HUNT FOR DREAD OCTOBER: 2021 POLICY IMPACTS

October 1, 2020

Cowen Analysts: Eric Assaraf, Paul Gallant, Chris Krueger, Roman Schweizer, Jaret Seiberg, Rick Weissenstein

TRUMP PARTING SHOT AT COMAC COULD TROUBLE U.S. AERO SUPPLIERS, BOEING

November 23, 2020

Cowen Analyst: Roman Schweizer

EXPORT CONTROLS & TECH: TRUMP-TO-BIDEN

November 23, 2020

Cowen Analyst: Paul Gallant

THE WEIGHT: ELECTION DAY + 8, 2020 RESULTS & RECOUNTS - WASHINGTON WEEKLY

November 13, 2020

Cowen Analyst: Chris Krueger

NOV. 2-6: ELECTION 2020: DRUG PRICE CONTROL PROSPECTS UNDER DIFFERENT SCENARIOS

November 2, 2020

Cowen Analyst: Eric Assaraf

RUNNING ON EMPTY: EARLY 2020 VOTE, SWING STATE POLLS & COVID-19 SPIKE, UI DATA

October 27, 2020

Cowen Analyst: Chris Krueger

COWEN'S CANNABIS CATALYST SERIES PARTS 1- 8

October 2020

Cowen Analysts: Vivien Azer, Gerald Pascarelli, CFA, Chris Krueger, Jaret Seiberg, Eric Assaraf

HANDLE WITH CARE: TRUMP CONDITION, PHASE 4, DEBATE & SUPREME COURT - WEEK AHEAD

October 4, 2020

Cowen Analyst: Chris Krueger

SELECTED EVENTS

2020 POST ELECTION FORUM

November 5, 2020

COWEN'S CANNABIS CATALYST SERIES

October 2020

Conference Call

UBER/LYFT AB5 EXPERT CONFERENCE CALL: UPDATE ON PROP 22 AHEAD OF ELECTION DAY

October 26, 2020

Conference Call

MARKET POSITIONING INTO THE ELECTION AND ITS IMPLICATIONS FOR THE COMMUNICATIONS SERVICES SECTOR

October 13, 2020

Conference Call

WRG REACTION: 2021 POLICY IMPACTS – WHAT TO EXPECT

October 1, 2020

Conference Call

2020 UPDATE & DEBATE PREVIEW WITH ROMNEY PRESIDENTIAL CAMPAIGN MANAGER

September 29, 2020

Conference Call

2020 ELECTION PREVIEW WITH POLITICO EDITOR CHARLIE MAHTESIAN

September 14, 2020

Conference Call

WASHINGTON WEEKLY: PHASE 4, BIDEN VP & 2020 ELECTIONS

August 14, 2020

Conference Call

2020 UPDATE WITH SENATE GOP CAMPAIGN CONSULTANTS

August 6, 2020

BIDEN TAX PLAN WITH FORMER SENIOR CONGRESSIONAL TAX STAFFER

July 22, 2020

Conference Call

WASHINGTON WEEKLY: PHASE 4, BIDEN ECONOMIC PLAN & 2020 ELECTIONS

July 10, 2020

Conference Call

10 DAYS TO IOWA –2020, IMPEACHMENT & TRADE: LATEST & GREATEST

January 24, 2020

Conference Call

U.S./CHINA COMPETITION & DECOUPLING

The U.S.-China relationship continues to deteriorate, setting the stage for further economic detachment. Trade in goods, services, capital, labor, technology, and data could be severely restricted with a counterparty that will soon be the world's largest economy. A rebalancing of the U.S.-China relationship could be the most significant investment theme for the next decade and touch almost every part of the global economy. Supply chains, investment restrictions, and export controls will be the primary fronts in 2021 and beyond.

 **WATCH VIDEO** ROMAN SCHWEITZER



WHAT WE'RE WATCHING

- Trump administration final actions
- China-targeted provisions in current legislation
- Biden admin nominations impacting China policy
- Regional geopolitical and trade risk
- Biden admin approach to Pacific alliances/agreements (trade and defense)

RELATED THEMES

- Election 2020
- New paradigms in computing
- Big tech & government
- ESG / Energy transition



“A complete economic decoupling may not occur, but there is a very strong likelihood competing economic-tech ecosystems will develop. Congress has been tougher and more consistent on China policy than Trump. Policy risk is increasing and broadening across more sectors.”

— **AHEAD OF THE CURVE® SERIES**

The U.S. & China In The Ring Of Fire



16%

OF CY20 WAFER FAB EQUIPMENT
SPEND ATTRIBUTED TO CHINA

There is one bipartisan issue in
Washington, DC: challenging the Chinese
Communist Party.

— **AHEAD OF THE CURVE® SERIES**

The U.S. & China In The Ring Of Fire



The U.S.-China Relationship Has Become Overtly Competitive On Many Levels And We See Genuine Risk Of Significant Economic Detachment



Source: Cowen and Company

U.S. Government Policy Toward China Will Affect Almost Every Industry, With The Greatest Potential Impact On Technology



ECONOMIC IMPACTS

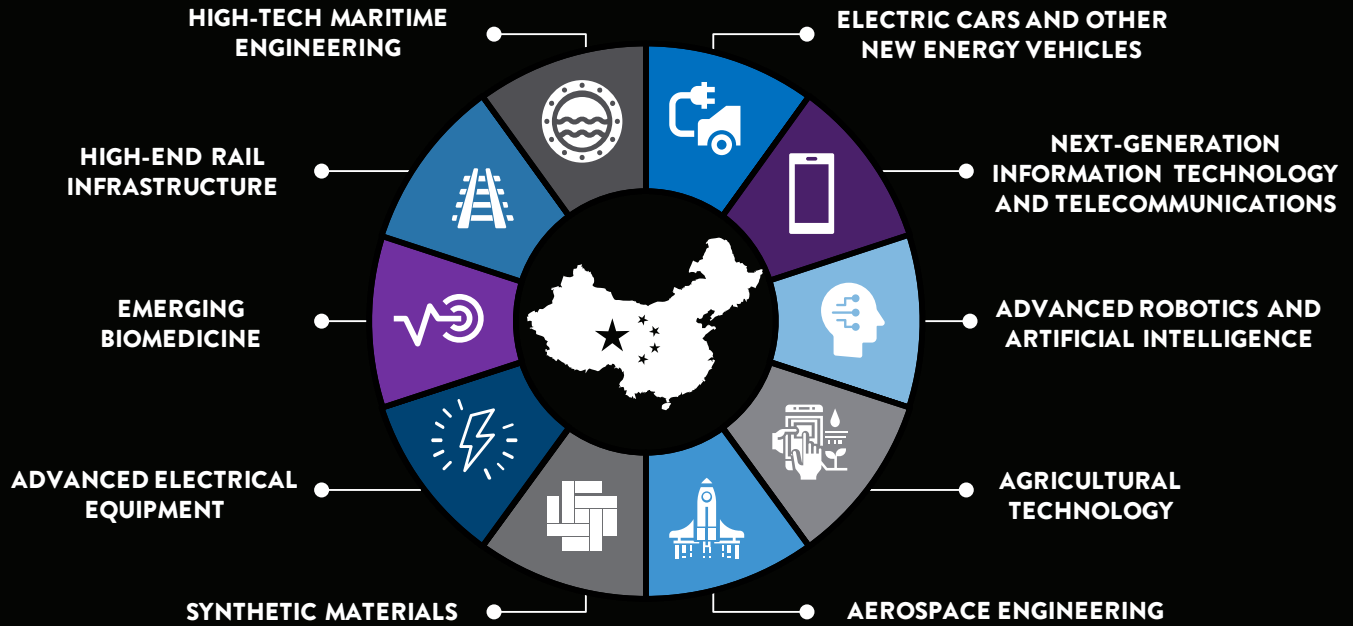
What Started As A Trade War Has Escalated, Particularly in Key Technology Areas

- The risk is increasing and broadening across more sectors.
- A growing range of high-tech areas will be firewalled, competitive, and subject to M&A, FDI, and export restrictions.
- Blunting China's dominance in 5G is the current front line, but we see the areas of greatest impact in technology, such as semiconductors, microelectronics, artificial intelligence, quantum computing, power storage, advanced materials, and other "emerging technologies." We believe a Biden Administration would represent a modestly more favorable export control environment for semis and semicap companies.
- Other industries (aerospace, air cargo, consumer softlines, energy, pharma, materials, industrials) will face new market dynamics, production shifts and costs, and export restrictions.

Source: Cowen and Company



Economic Power And Technology Leadership Are Intertwined, And China Aspires To Dominate Ten New “High Tech” Industries Of The Future Through Its 2025 Plan



Source: Cowen and Company

China Views These Sectors As Central To A “Fourth Industrial Revolution” Which Refers To The Integration Of Big Data, Cloud Computing, And Other Emerging Technologies Into Global Manufacturing Supply Chains

By 2025, China aims to achieve 70 percent self-sufficiency in high-tech industries

By 2049—the hundredth anniversary of the People’s Republic of China—it seeks a dominant position in global markets

SUCCESSFUL EXAMPLES OF THIS IN DIFFERENT INDUSTRIES



Worldwide leader in telecommunications equipment



Mandate to become the world-wide leader in AI



Ties Amazon as the global leader in e-commerce



The U.S. Government Has Been Adopting Strategies And Tactics To Confront Chinese Economic, Diplomatic, And Military Policies

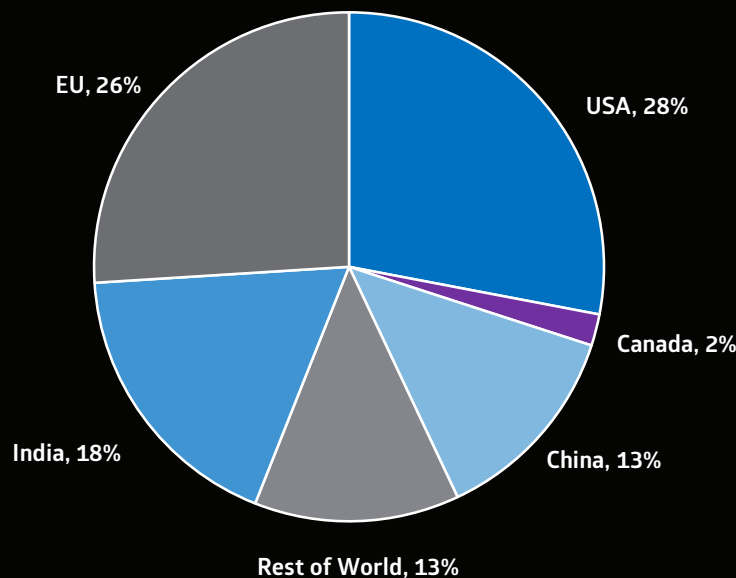
U.S. RESPONSE TO CHINA 2025 PLAN

U.S. RESPONSE	CURRENT STATUS
Block Federal Pension Investments in Chinese Stocks	Implemented through Executive Action
Block Chinese Acquisition of U.S. Financial Firms	Implemented through Executive Action
De-List Chinese Stocks from U.S. Exchanges	Pending on Capitol Hill
Block U.S. Investments in Chinese Banks	In Discussion
Bar Hong Kong from Dollar Clearing	In Discussion
Cancel Treasuries that China Owns	In Discussion
Force Chinese Banks Out of U.S.	In Discussion
Block exporting to Chinese aerospace companies	In Discussion

Source: Cowen and Company

COVID-19 Has Exposed Drug Supply Chain Vulnerabilities. Onshoring Is A Resonant Theme Among Lawmakers, But Strict Requirements To Onshore Are Not Likely In The Near Term

API MANUFACTURING FACILITIES FOR ALL DRUGS BY COUNTRY OR REGION (AUGUST 2019)



Source: Cowen and Company



COWEN ANALYSTS

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JARET SEIBERG
CHRIS KRUEGER
RICK WEISSENSTEIN
ERIC ASSARAF
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REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES

THE U.S. & CHINA IN THE RING OF FIRE

November 6, 2020

Cowen Analyst: Roman Schweizer, Cowen Washington Research, Cowen Research

CHINA DE-LISTING LEGISLATION COULD GET FINAL PUSH ON CAPITOL HILL NEXT MONTH

November 25, 2020

Cowen Analyst: Jaret Seiberg

EXPORT CONTROLS & TECH: TRUMP-TO-BIDEN

November 23, 2020

Cowen Analyst: Paul Gallant

EXPANDING LINKS BETWEEN NATIONAL SECURITY & TECH

October 19, 2020

Cowen Analyst: Roman Schweizer

TRUMP'S WIDENING BLOCKADE OF HUAWEI

August 20, 2020

Cowen Analyst: Paul Gallant

BEST SMIDCAP IDEAS: LOOKING AT WASHINGTON POLICY UPSIDE

June 25, 2020

Cowen Analysts: Cowen Washington Research Group

ASSESSING TRUMP'S OPTIONS FOR LIMITING FINANCIAL TIES WITH CHINA

June 11, 2020

Cowen Analyst: Jaret Seiberg

XI'S GONE: US-CHINA FLASHPOINTS ON TARIFFS, CAPITAL/EXPORT CONTROLS & SANCTIONS

May 27, 2020

Cowen Analyst: Chris Krueger

COWEN COMPANY COVERAGE

ACACIA COMMUNICATIONS **ACIA**
 ADIDAS AG **ADS.GR**
 ADTRAN **ADTN**
 ADVANCED MICRO DEVICES **AMD**
 ALLEGHENY TECHNOLOGIES **ATI**
 AMBARELLA **AMBA**
 APPLIED MATERIALS **AMAT**
 APPLE **AAPL**
 ASML HOLDING **ASML.NV**
 BOEING COMPANY **BA**
 BROADCOM LTD **AVGO**
 CALIX **CALX**
 CALLAWAY GOLF **ELY**
 CIENA **CIEN**
 CISCO SYSTEMS **CSCO**
 COLUMBIA SPORTSWEAR **COLM**
 COMMERCIAL METALS CO **CMC**
 DICK'S SPORTING GOODS **DKS**
 ERICSSON **ERIC**
 FEDEX CORP. **FDX**
 G-III APPAREL GROUP LTD **GIII**
 II-VI INCORPORATED **IIVI**
 INPHI CORPORATION **IPHI**
 INTEL **INTC**
 JUNIPER NETWORKS **JNPR**
 KLA CORPORATION **KLAC**
 LAM RESEARCH **LRCX**

LULULEMON ATHLETICA **LULU**
 MICRON TECHNOLOGY **MU**
 MOTOROLA SOLUTIONS **MSI**
 NEOPHOTONICS **NPTN**
 NIKE **NKE**
 NOKIA (ADR) **NOK**
 NUCOR CORP. **NUE**
 PACCAR **PCAR**
 PUMA GR **PUM.GR**
 PURE STORAGE **PSTG**
 PVH CORP. **PVH**
 QUALCOMM **QCOM**
 RALPH LAUREN **RL**
 SCHNITZER STEEL INDUSTRIES **SCHN**
 SEAGATE TECHNOLOGY **STX**
 SEMTECH CORP. **SMTC**
 SKECHERS **SKX**
 SKYWORKS SOLUTIONS **SWKS**
 STEEL DYNAMICS **STLD**
 U.S. STEEL CORP. **X**
 UNDER ARMOUR **UAA**
 VF CORPORATION **VFC**
 WESTERN DIGITAL CORPORATION **WDC**
 YETI HOLDINGS **YETI**

SELECTED EVENTS

COWEN DC DEFENSE DAY VIRTUAL BUS TOUR

August 11, 2020

WASHINGTON WEEKLY: HE SAID, XI SAID: US & CHINA IN THE RING OF FIRE – POLICY UP

July 17, 2020

Conference call

THE NEW SPACE RACE AND GETTING READY FOR STAR WARS

May 1, 2020

Conference call

DOD HYPERSONICS: A HYPER-FAST GROWING MARKET

April 15, 2020

Conference call

U.S. FOREIGN POLICY WITH SECRETARY OF STATE MIKE POMPEO

March 6, 2020

Conference call

BIG TECH & GOVERNMENT

Shifting consumer habits and workplace dynamics, amplified by COVID-19, have led to increased reliance on Big Tech's offerings and record profits. This coupled with diminishing competition across a number of categories has made the industry a target for government intervention. The energy in the Democratic party is steering toward aggressive action. Although a Republican Senate could have a moderating effect on a Democratic-led agenda, we see more antitrust lawsuits and legislation on the horizon.

 **WATCH VIDEO** PAUL GALLANT



WHAT WE'RE WATCHING

- DOJ, FTC, FCC appointees and tech policy
- Antitrust lawsuits and legislation
- Future acquisitions
- Trade & tariffs

RELATED THEMES

- Election 2020
- Consumer transformation
- Edge computing & 5G
- New paradigms in computing
- Robotics & automation
- U.S./China competition & decoupling



“We think a Biden FTC would open rulemakings for possible regulation of platforms on several areas: self-preferencing, algorithmic bias, mandatory data sharing/interoperability, privacy and halting acquisitions of early-stage companies that might eventually compete with the platforms. The FTC rarely conducts rulemakings, so we believe this scenario is underappreciated.”

— **AHEAD OF THE CURVE® SERIES**

The Hunt for Dread October: Senate Deep Dive & 2021 Policy Impacts



\$899B

COMBINED REVENUE IN
2019 FOR APPLE, AMAZON,
ALPHABET, MICROSOFT
AND FACEBOOK

“It’s the President - not Congress - who controls most tech policy by appointing the heads of the DOJ, FTC and FCC. Those agencies decide whether to file lawsuits or impose new regulations.”

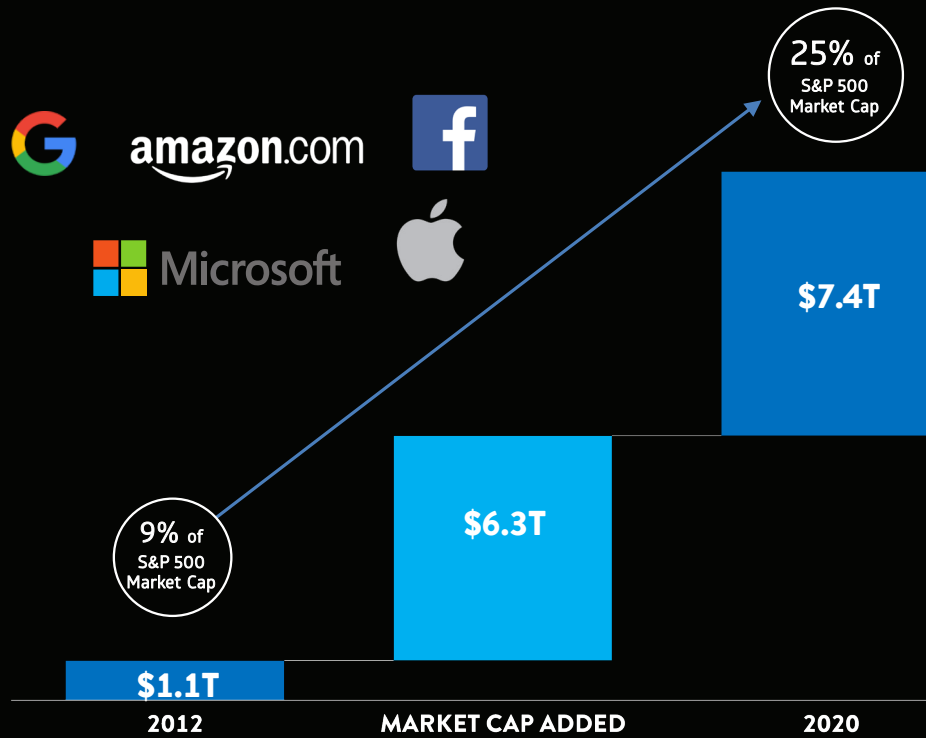
— **PAUL GALLANT**

Elections and Tech/Telecom, at the Moment



The Economic Power Of The Top 5 Tech Platforms Has Scaled Dramatically

TOP 5 TECH COMPANIES, MARKET CAP AND PERCENT OF S&P 500, 2012 AND TODAY



Source: Cowen and Company





Platforms Are Evolving Toward A Unified Stack, Controlling Each Stage Of The Customer Journey

CUSTOMER JOURNEY	ACCESS	Hardware	●	●	●	●	
		OS	●	●	●	●	
		Browser	●	●	●	●	
	DISCOVERY	Cloud Services	●	●	●	●	●
		Search Engine	●	●	●	●	●
		Virtual Assistant	●	●	●	●	●
		Social Network	●	●	●	●	●
	CONSUMPTION	Ad Stack	●	●	●	●	●
		Sponsored Content	●	●	●	●	●
		First-Party Publishing	●	●	●	●	●
		E-Commerce	●	●	●	●	●
		Payment/Wallet	●	●	●	●	●

Source: Cowen and Company



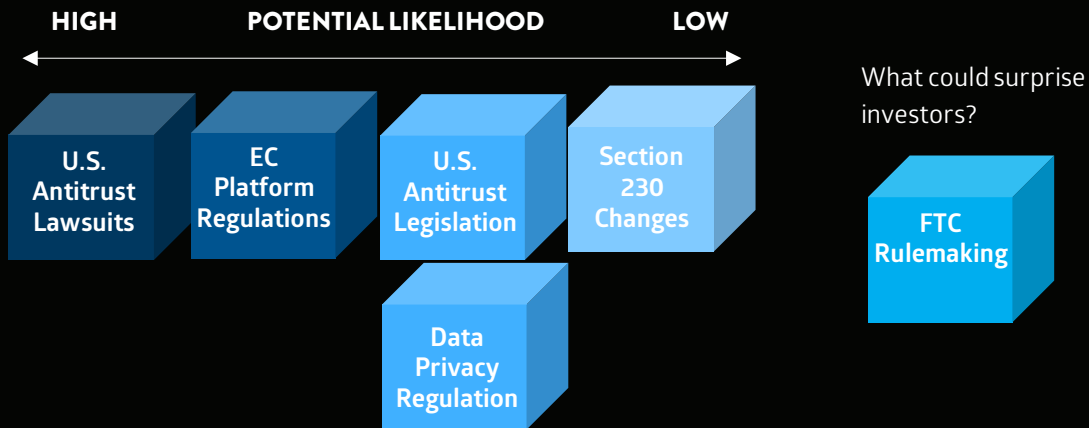
Big Tech Is Attracting Regulatory Scrutiny By Multiple Agencies

EUROPEAN UNION	
 <p>European Commission</p>	<p>EU V. BIG TECH</p> <p>Digital Service Act For Internet Platforms. The European Commission is proposing legislation that could significantly affect Google/Apple/Facebook/Amazon. If adopted, it would ban self-preferencing by platforms, affect app store payment models, and require data sharing with smaller competitors. The key for investors is whether Europe’s bureaucracy is capable of enforcing such sweeping requirements.</p>
UNITED STATES	
 <p>Department of Justice</p>	<p>U.S. V. GOOGLE</p> <p>The DOJ alleges that Google uses exclusionary conduct to preserve its search monopoly. The lawsuit alleges that Google has lawfully acquired monopolies in the search (90%) and search advertising (70%) markets. However, the DOJ alleges that Google unlawfully maintains that monopoly via exclusionary tactics including paying Apple and Android OEMs to make Google the default search service. DOJ and/or state AGs are likely to file additional lawsuits against Google.</p>
 <p>Federal Trade Commission</p>	<p>FTC V. FACEBOOK</p> <p>FTC and 48 state attorneys general filed separate lawsuits against Facebook. The lawsuits allege antitrust violations and seek court orders to unwind Facebook’s acquisition of Instagram and WhatsApp.</p>
 <p>U.S. Congress</p>	<p>HOUSE TECH / ANTITRUST REPORT</p> <p>Passage of tougher antitrust laws vs tech are likely, but Congress mandating structural separation is an uphill battle.</p> <p>Overhaul of Section 230 of the 1996 Communications Decency Act that protects online platforms from being sued over what people post on them.</p>

Source: Cowen and Company

Potential Government Actions Could Take Several Forms, Including An FTC Rulemaking, An Underappreciated Alternative

POTENTIAL GOVERNMENT ACTIONS



Source: Cowen and Company



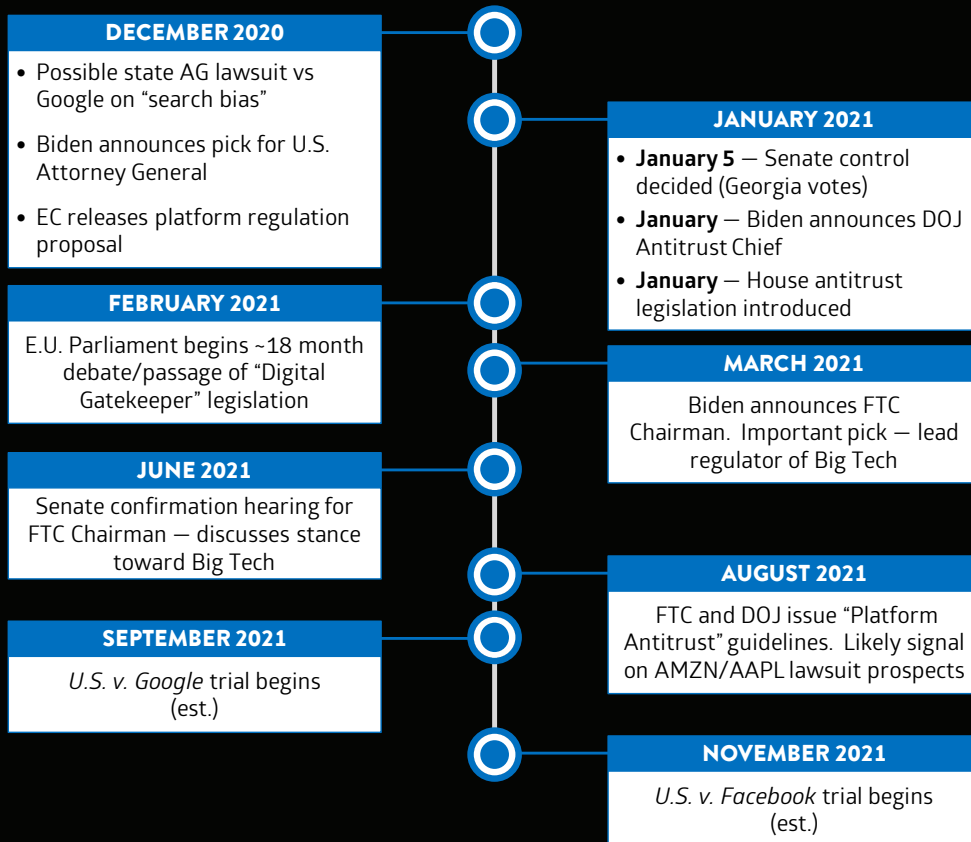
Big Tech Has Three Very Powerful Levers That May Well Protect Them Against Impactful Government Actions



Source: Cowen and Company

What's Next?

12-MONTH TIMELINE FOR U.S. AND E.C. PLATFORM ANTITRUST EVENTS



Source: Cowen and Company



COWEN ANALYSTS

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REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES

THE NEXT TWO YEARS FOR BIG TECH IN THE U.S. AND EUROPE

December 10, 2020

Cowen Analyst: Paul Gallant

AHEAD OF THE CURVE® SERIES

GEN Z/MILLENNIALS: SUSTAINABILITY SUPPORTS DURABILITY

October 14, 2020

Cowen Analysts: John Kernan, CFA, Vivien Azer, John Blackledge, Andrew M. Charles, CFA, Oliver Chen, CFA, George Mihalos

AHEAD OF THE CURVE® SERIES

US ECOMMERCE DISRUPTION 4.0: PANDEMIC IMPACT HAS STAYING POWER

October 13, 2020

Cowen Analyst: John Blackledge

AHEAD OF THE CURVE® SERIES

THE HUNT FOR DREAD OCTOBER: SENATE DEEP DIVE & 2021 POLICY IMPACTS

October 1, 2020

Cowen Analysts: Eric Assaraf, Paul Gallant, Chris Krueger, Roman Schweizer, Jaret Seiberg, Rick Weissenstein

AHEAD OF THE CURVE® SERIES

ASSESSING AMZN'S NON-US ECOMMERCE & PRIME OPPORTUNITY

March 10, 2020

Cowen Analyst: John Blackledge

ELECTIONS AND TECH/TELECOM, AT THE MOMENT

November 4, 2020

Cowen Analyst: Paul Gallant

COWEN COMPANY COVERAGE

ALPHABET **GOOG**
AMAZON.COM **AMZN**
APPLE **APPL**
FACEBOOK **FB**
MICROSOFT **MSFT**

SELECTED EVENTS

POST-ELECTION DC TMT DAY

November 18, 2020

2020 POST-ELECTION FORUM

November 5, 2020

AMAZON EXPERT CALL

September 30, 2020

Conference call

WHAT'S NEXT FOR GOOGLE, FACEBOOK & APPLE ON ANTITRUST?

September 28, 2020

Conference call

DISSECTING ELECTION RISK FOR FINANCIALS & HOUSING

September 22, 2020

Conference call

INTERNET & MEDIA BUS TOUR

August 7 -11, 2020

2020 TECHNOLOGY, MEDIA & TELECOM CONFERENCE

May 29-30, 2020

SEMI CAP EQUIPMENT IMPACT FROM FOREIGN DIRECT PRODUCT RULE

April 8, 2020

Conference call

DC DAY: TMT POLICY

February 5, 2020

FROM COWEN CHAIR & CEO
JEFFREY M. SOLOMON

EQUITY & FAIRNESS

Equity. In the investment universe, that word is synonymous with stocks. Every day, we spend the majority of our waking hours watching and analyzing the equity markets. We pore over the operating performance of public companies as we assess the value of their equity. As investors and executives, we compare our performance to equity indices and selected baskets of equities. In short, we obsess about equity.

Or do we?

A closer look at the definition of the word suggests that we open the aperture when it comes to our focus on “equity.” According to Merriam-Webster, the first definition of equity is “justice according to fairness.” In contrast, “the common stock of a corporation” ranks much lower on the list of definitions.

 [WATCH VIDEO](#) JEFFREY M. SOLOMON



WHAT WE'RE WATCHING

- Gender and racial board diversity for publicly listed companies
- Social justice and inclusion focus in the cannabis industry



4.7x

Rate of COVID-19 hospitalizations of Black or African American, non-Hispanic vs. White, non-Hispanic persons – CDC

73% vs. 27%

Percent of venture capital dollars concentrated in CA, NY and MA vs. the rest of the U.S. – 2020 NVCA Yearbook



+0.2% vs. -19%

Change in employment vs. pre-COVID-19 levels for high wage vs. low wage earners – Opportunity Insights, as of October 2020

1 in 2

Number of small businesses that could survive 3 months or less without cash flow – Womply



The events of 2020 have demonstrated that, as a society, we have a long way to go to achieve equity and fairness. While COVID-19 has affected all of us in one way or another, it has a disproportionate impact on communities of color. That is not equitable. The murders of George Floyd, Breonna Taylor, Ahmaud Arbery, and Rayshard Brooks, among many others, have highlighted inequities in the way that Black communities are policed. This reality forces us all to consider our roles in perpetuating racial bias and our responsibilities to bring about positive change in racial equity in our communities and at work.

Over the last few years, other underrepresented groups have also voiced their concerns about a lack of fair treatment. The #MeToo movement speaks to the continued challenges in achieving gender equity and respect in the workplace and beyond. In addition, the disaffection expressed vocally by those who live in both rural communities and inner cities has given rise to populism on the right and the left, speaking to a lack of fairness when it comes to opportunity and economic access.

We need to ask ourselves: Is it fair that equity markets have made all-time highs in 2020 while many small businesses and their employees continue to struggle to make ends meet? Is it fair that bigger corporations, with access to the capital markets and other capital sources, are more likely to survive the current economic downturn? Is it fair that COVID-19 has left so many municipalities and local governments unable to provide vital social services? How will these inequities be addressed? What is our role in helping to repair the fabric of our society when it seems so frayed?

As we head into 2021, we will have a new President and Vice President who campaigned on the idea that we can be and should be a more fair and more inclusive society, especially in terms of economic opportunity and social mobility. They championed the notion that advancement should be more merit-based and less about race, ethnicity, gender, or sexual orientation.

That everyone should have a fair chance to achieve the American Dream is not a new idea, but the ideal of what the American Dream embodies may be changing. Recent surveys suggest that more people, particularly millennials, believe that the current form of capitalism needs to be rethought if it is to survive.

Some will read that last statement through a political lens. I urge you not to. Fairness doesn't know politics. Neither the left nor the right has a trademark on the concept. Instead, consider fairness to be a fundamental human desire. Said another way, who doesn't want to be treated fairly? Who doesn't want the chance to better themselves socioeconomically?

As business leaders and investors, we must continue to use our privileged positions not only to advocate for fairness, but to demand it. We are the ones who can rethink how to engage in a form of participatory capitalism that is more equitable, more inclusive. The history of social change often begins with economic pressure brought to bear on corporations to act more fairly and with greater responsibility for enacting positive social change. But it doesn't have to be that way. Business leaders and shareholders can recognize that their economic incentives are aligned with, and often improved by, the concepts of inclusion, diversity, and basic fairness. In our business strategies, if we apply the primary definition of equity, then individually and collectively, we can evolve our form of capitalism into one that does a better job of closing the wealth and income gaps. We can enable economic growth that is more inclusionary, particularly as we emerge from the current virus-induced downturn.






At Cowen, we are on our own journey to be fairer and more inclusive. We are more intentional in our actions so that they match our words and our values. As we conduct our business, we do so through the lens of Empathy, one of our core values, by considering the impact we make on our colleagues, clients, and communities. Those constituents include our own equity holders. Our effort isn't new, but it has taken on increased urgency as we exit 2020.

As you read through our Investment Themes for 2021, I encourage you to consider focusing your efforts on companies and industries that place a premium on fairness. Support businesses that drive not only financial returns on equity, but also provide equity on those returns as well. Equity in the sense of inclusion. Equity in the sense of opportunity. Equity in the sense of fairness.

Jeffrey M. Solomon

Chair and Chief Executive Officer

Some Ways Cowen Is Supporting Its Beliefs With Actions

INITIATIVE	DESCRIPTION
 PARTNERSHIP for New York City	Cowen is a member of the Partnership for New York City, joining top business leaders from all sectors of the economy and representatives of companies with a major presence in, and commitment to, NYC. This year's focus is on building the multiple public-private partnerships that will be required to sustain NYC's health and human services systems and to develop the plans and programs that will enable the city to rebuild its economy in the wake of the pandemic.
	Cowen has partnered with GoodToday, a charitable giving platform that has become the world's largest workplace giving community. GoodToday provides an easy and meaningful way for companies to give back daily to hundreds of new causes and organizations across the globe as well as respond to issues in real-time. Through a daily email, our employees allocate a Cowen-sponsored donation between two featured charities every business day.
CEO ACT!ON FOR DIVERSITY & INCLUSION	Cowen Chair and CEO Jeff Solomon pledged to take action to advance diversity and inclusion in the workplace through the CEO Action for Diversity & Inclusion™ coalition. In signing the CEO Action Pledge, Cowen joins other leading companies across the U.S. that commit to being a positive force for inclusion and diversity through specific actions.
 SEO Seizing Every Opportunity	Cowen has partnered with Sponsors for Educational Opportunity, an educational non-profit dedicated to expanding professional opportunities and maximizing success for top diverse talent in Corporate America.
RACIAL EQUITY CEO STATEMENT	A statement from Cowen Chair and CEO Jeffrey Solomon on the importance of inclusion and diversity as catalysts for success, growth and innovation. Among the messages is the importance of authentic conversations about difference and equity in the workplace to build awareness and empathy and counter unconscious bias.
COWEN I&D MISSION STATEMENT	We pride ourselves on our empathetic and collaborative culture, where the power of diversity is harnessed to transform the status quo. Our focus on inclusion expands our thinking in order to generate better outcomes for clients, while striving to increase fairness and equity for our colleagues. Cowen's vision of creating a more inclusive and equitable future is supported by our core values and is essential to our ability to outperform.
ESTABLISHED I&D FUNCTION	Appointed Ripa Rashid as Head of Inclusion and Diversity to launch an inclusion and diversity strategy for Cowen. With a focus on talent, culture and community, the inclusion and diversity approach is business-driven, with a focus on metrics and reporting, diverse talent attraction and development, and inclusive leadership and culture.

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SELECT **2021 COWEN CONFERENCES**

42ND ANNUAL AEROSPACE/DEFENSE CONFERENCE
February 2021

41ST ANNUAL HEALTH CARE CONFERENCE
March 2021

49TH ANNUAL TECHNOLOGY, MEDIA & TELECOM CONFERENCE
June 2021

5TH ANNUAL FUTUREHEALTH CONFERENCE
June 2021

7TH ANNUAL COMMUNICATIONS INFRASTRUCTURE SUMMIT
August 2021

14TH ANNUAL GLOBAL TRANSPORTATION CONFERENCE
September 2021

24TH ANNUAL THERAPEUTICS CONFERENCE
October 2021

10TH ANNUAL MEDTOOLS UNLOCKED CONFERENCE
October 2021

3RD ANNUAL PRIVATE COMPANY SUMMIT
October 2021

5TH ANNUAL BOSTON CANNABIS CONFERENCE
December 2021

JANUARY 2021

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