



for the Built Environment

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North American Megaprojects

2019

Methodology and North American overview

Megaprojects Defined:

There is no one universal definition of a megaproject. FMI, using a threshold of \$1 Billion or more, identified historical and planned engineering megaprojects across multiple sources and databases. Large, long-term capital plans were excluded from this analysis.

Megaprojects are widely defined as large-scale, complex ventures that typically cost \$1 billion or more and may take years to develop and build, involve multiple public and private stakeholders, are transformational and impact millions of people (Flyvbjerg, 2014).

Megaproject Segmentation:

Commercial and Mixed Use – Includes projects predominantly within lodging, office, retail, warehouse and distribution, amusement and recreation, and communication segments. Also includes residential single-family and multifamily mixed-use developments.

Institutional – Includes projects predominantly within health care, educational, religious or public safety segments.

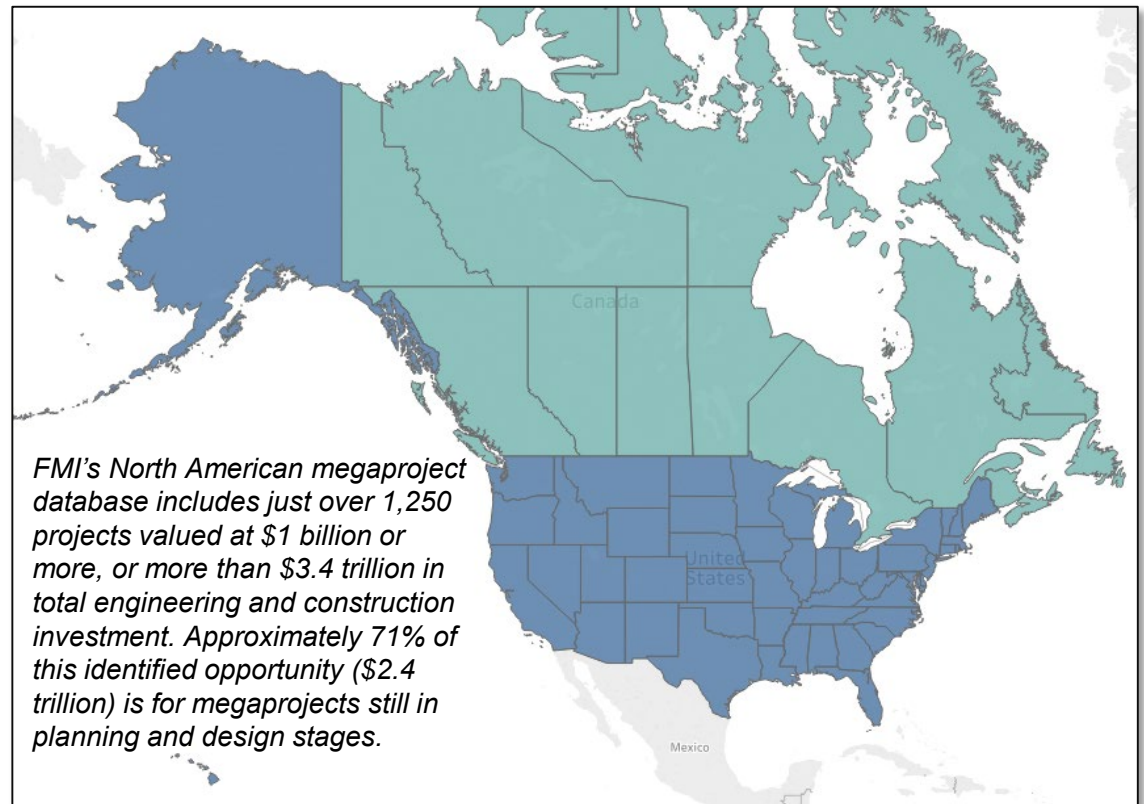
Transportation – Includes nonresidential building projects for airports, railways (including both transit and freight rail) and/or ports (including both waterway or inland ports).

Industrial – Includes all manufacturing and industrial projects.

Infrastructure – Includes all nonresidential structures involving power, highway and street, sewage and waste disposal, water supply, and conservation and development investment.

Study Map:

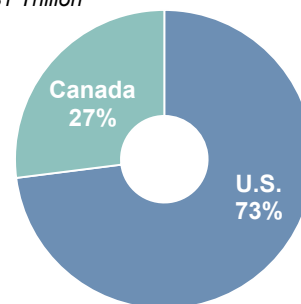
Shading illustrates historical volume of spend by country, 2007-2019.



Past and underway megaprojects

North America, 2007-2019 \$ millions

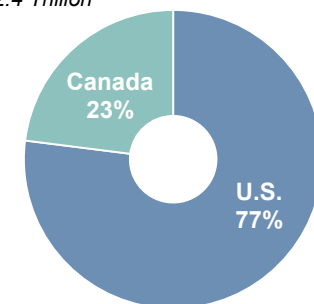
~\$1 Trillion



Megaprojects in planning and design

North America, 2019-2050 \$ millions

~\$2.4 Trillion



Megaproject trends and drivers

The world need to spend an estimated \$57 trillion on infrastructure by 2030 to enable the anticipated levels of GDP growth. Two-thirds of spending will be required in developing countries to support rising middle classes, population growth, urbanization and increased economic growth.

Historical megaproject performance

- Nine out of 10 megaprojects go over budget
- Time overruns are a perennial problem
- Rail megaprojects go over budget on average 44.7%, and demand is overestimated by 51.4%
- Bridge and tunnel megaprojects on average incur 35% cost overruns.
- Road megaprojects on average incur 20% cost overruns.

Reasons megaprojects fail:

- *Overoptimism and overcomplexity*
- *Poor execution*
- *Low productivity*
- *Weakness in organizational design and capabilities*
- *Lack of resources*

Known solutions to megaproject challenges:

- *Stakeholder alignment and confirmation of justification*
- *Resource and expertise acquisition*
- *Upfront planning (3% to 5% of capital costs on early stage engineering and design)*
- *Oversight rigor across benefits, goals, schedules and costs*

Megaprojects are economically transformative. The world needs megaprojects to deliver economic growth and, theoretically, they pay for themselves. Getting them right, or at least making improvements, is win-win. **Other lasting benefits span innovation and technological advancements, co-leveraging resources across various public and private organizations, sustainability and ultimately inspiration toward future achievements.**

Planned start dates on megaprojects are difficult moving targets, given their inherent complexities and typical opposition. Likewise, in the event of widespread national or international economic slowdown, FMI expects planned megaprojects will be among the first group of projects to be redrawn, shelved or abandoned (depending on associated stakeholders and motives).

U.S. megaproject highlights

The average U.S. megaproject size is expected to increase 37%, from \$2.1 billion to \$2.9 billion, comparing awarded/historical projects between 2012 and 2018 with those in the forecast period between 2019 and 2023.

- Since 2012, 320 U.S. megaprojects have been awarded, representing \$718 billion in investment.
- FMI identified 674 U.S. megaprojects in planning, representing \$2 trillion in investment.

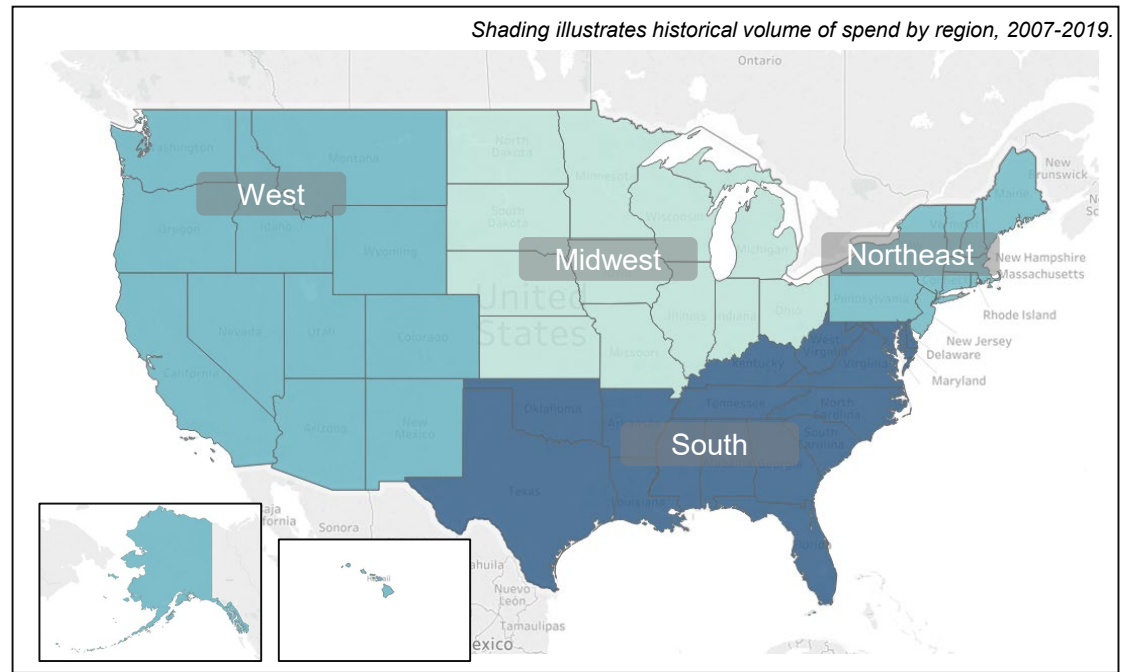
The annual value of megaproject starts in the U.S. has increased from 3% of total U.S. starts in 2013 to approximately 33% of total U.S. starts in 2018. Growth in historical megaproject spending has been led by industrial and infrastructure investments.

U.S. planned projects show an increasing share of spending into western states and into infrastructure and transportation.

- The South and the West Census regions are expected to represent the majority of planned megaproject spending across the U.S. at 37% and 30% of total, respectively.
- The top three states across the U.S. for planned megaproject spend represent 40% of the national total. These states include New York (15%), California (15%) and Texas (10%).

Annual megaproject construction put in place (CPiP) is expected to increase ~460% over the next five years, growing from \$53 billion to just over \$295 billion. Over the next decade, annual megaproject spending is expected to increase nearly 600%, reaching just over \$350 billion.

U.S. Regional Study Map (Census Regions):



Largest Five Megaprojects, Past and Planned

Past Projects, 2007-2019 (\$B)

Plant Vogtle Nuclear Reactor Expansion, Georgia (2010)	\$25.2
Nextgeneration NYCHA PACT Sites, New York (2019)	\$24.0
Exxon Mobil Plastics Plant, Texas (2017)	\$10.0
Corpus Christi LNG Export Terminal, Texas (2015)	\$10.0
Golden Pass Products Expansion, Texas (2019)	\$10.0

Planned Projects, 2019-2050 (\$B)

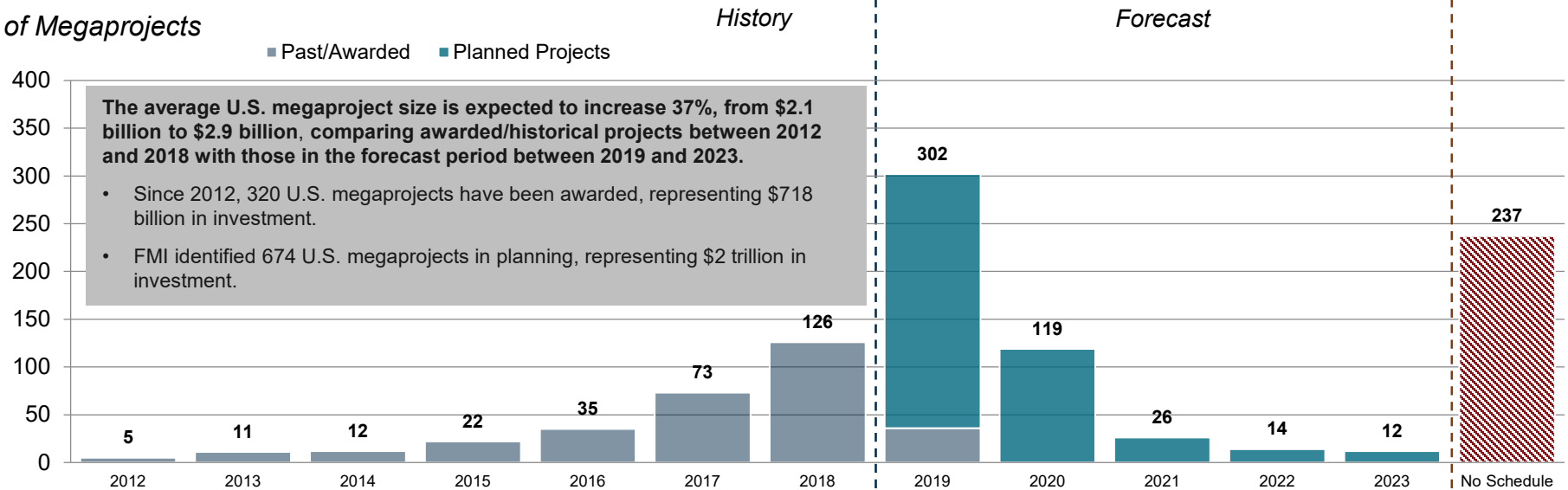
Westchester to Long Island Tunnel, New York (~2023)	\$55.4
Alaska Natural Gas Pipeline, Alaska (~2021)	\$43.4
G2 LNG Plant Expansion, Louisiana (~2019)	\$24.0
FP&L Turkey Point Reactors, Florida (~2023)	\$20.0
Texas Central High-Speed Line, Texas (~2020)	\$18.0

Source: FMI, Building permits, Reed, Dodge

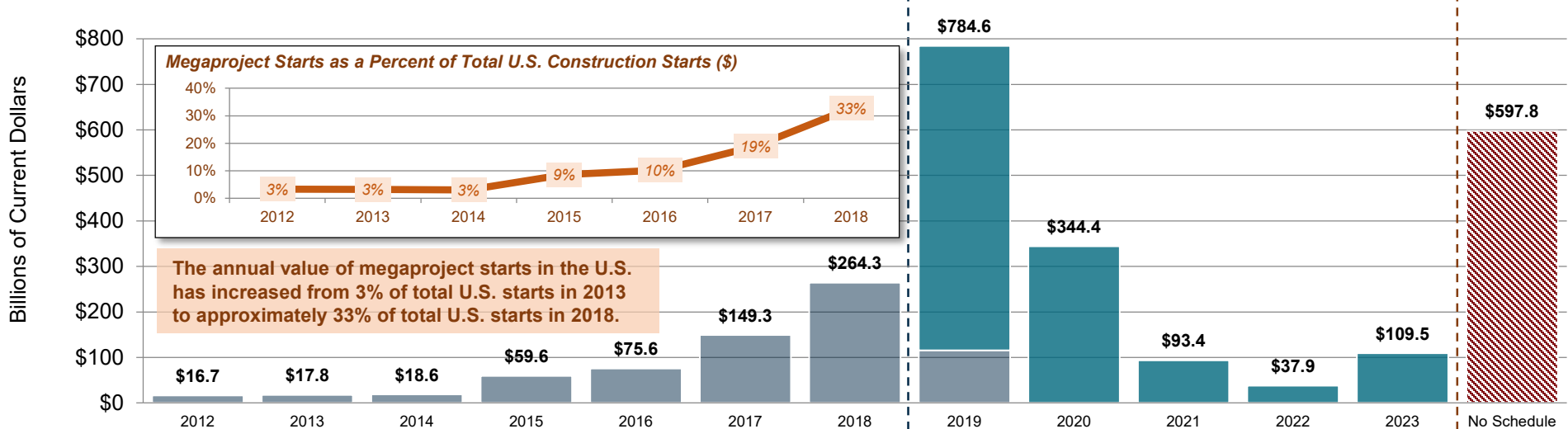
U.S. megaprojects, historical and planned activity

Construction starts/awards, as reported

Count of Megaprojects



Value of Megaprojects

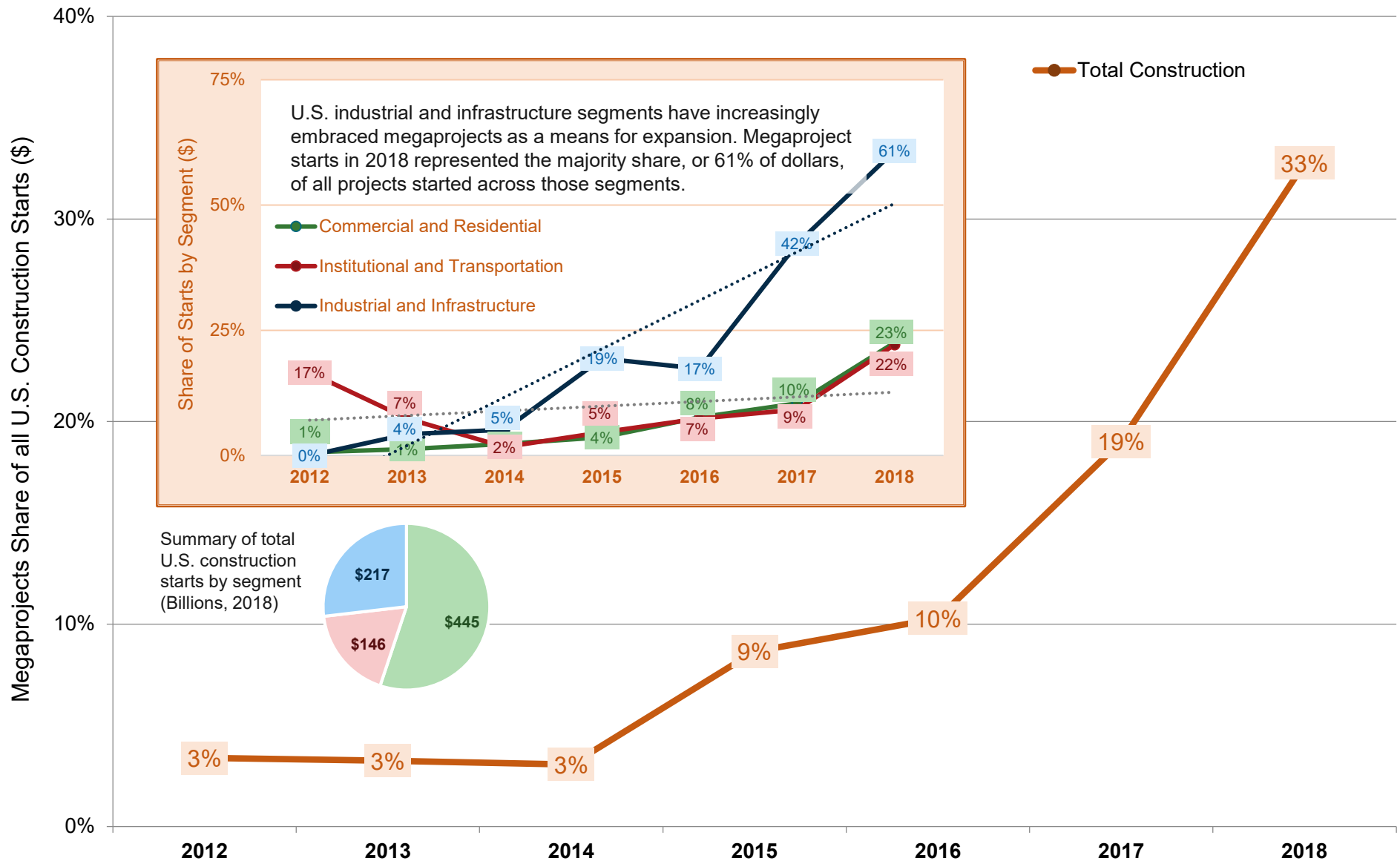


Average Project Size, Billions

2012	\$3.3	2013	\$1.6	2014	\$1.6	2015	\$2.7	2016	\$2.2	2017	\$2.0	2018	\$2.1	2019	\$2.6	2020	\$2.9	2021	\$3.6	2022	\$2.7	2023	\$9.1	No Schedule	\$2.5
\$2.1 (2012-2018 Full History)														\$2.9 (Full Forecast)											

Historical Megaproject Starts as a Share of all U.S. Construction Starts (\$)

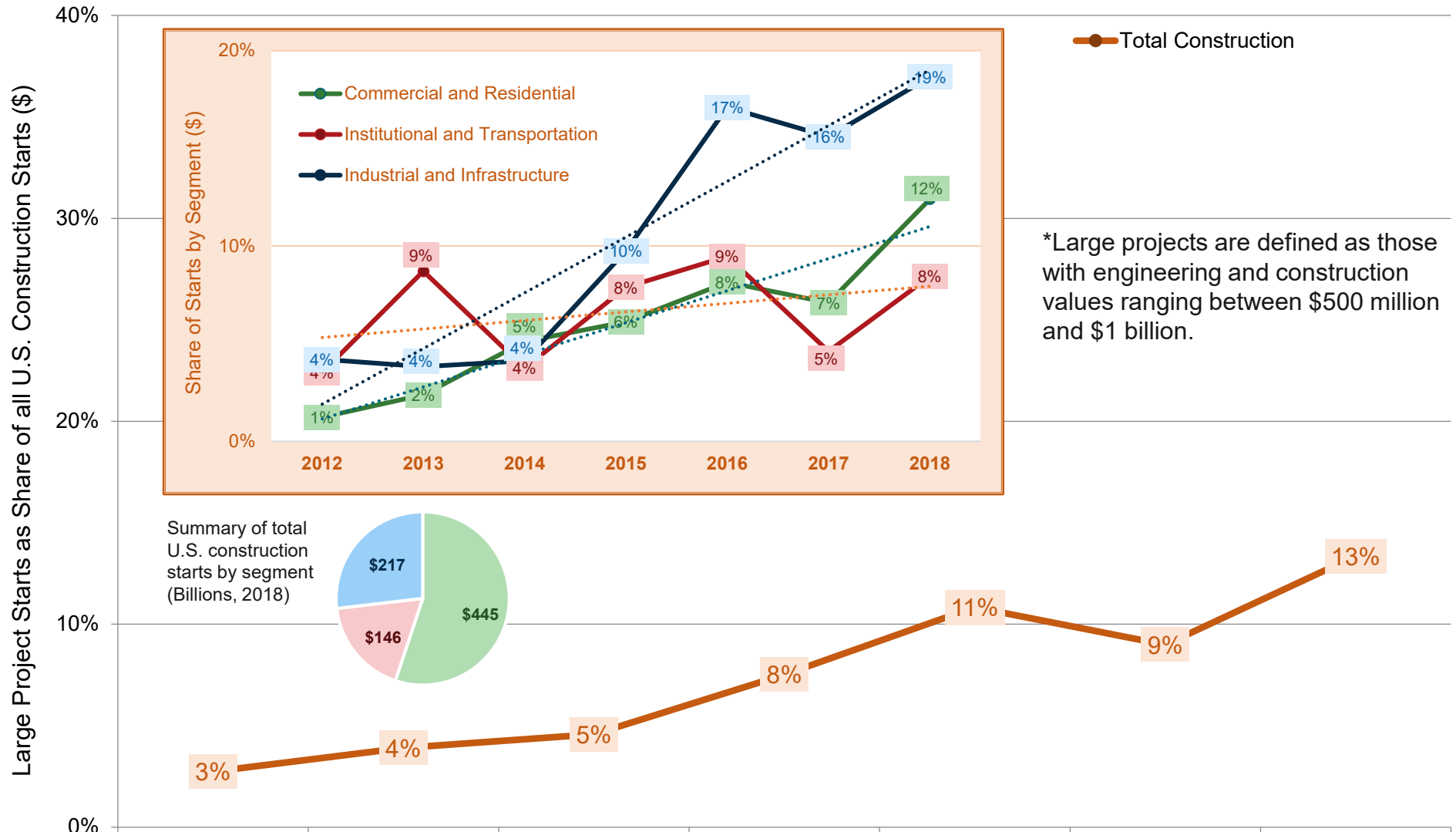
Growth in historical megaproject spending has been led by industrial and infrastructure investments.



	2012	2013	2014	2015	2016	2017	2018
Starts Value (\$B)	\$17	\$18	\$19	\$60	\$76	\$149	\$264
Starts Count	5	11	12	22	35	73	127

Large-Project* Starts (\$500M-\$1B) as a Share of all U.S. Construction Starts (\$)

Consistent with the trend seen prior, historical growth in large-project spending between \$500M and \$1B has also been led by industrial and infrastructure investments. However, at these size ranges, we are also finding that commercial and residential projects are consistently and more frequently becoming larger as well as increasingly complex.



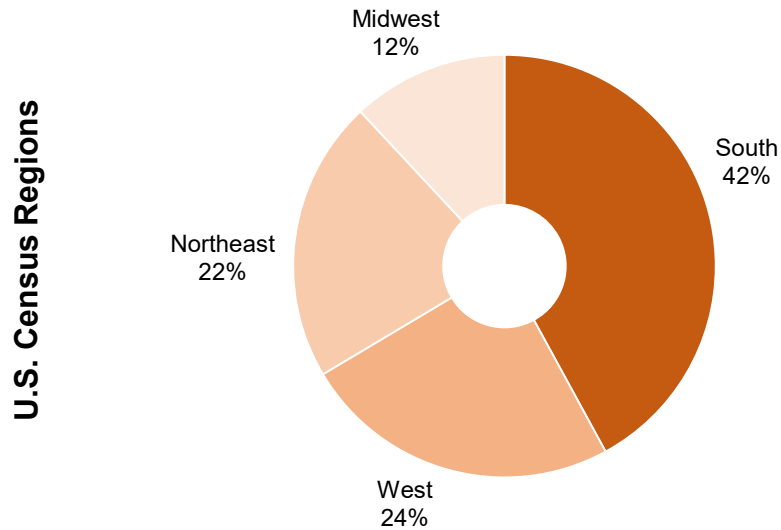
*Large projects are defined as those with engineering and construction values ranging between \$500 million and \$1 billion.

	2012	2013	2014	2015	2016	2017	2018
Starts Value (\$B)	\$13	\$21	\$28	\$52	\$80	\$71	\$108
Starts Count	22	31	41	79	121	109	169

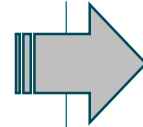
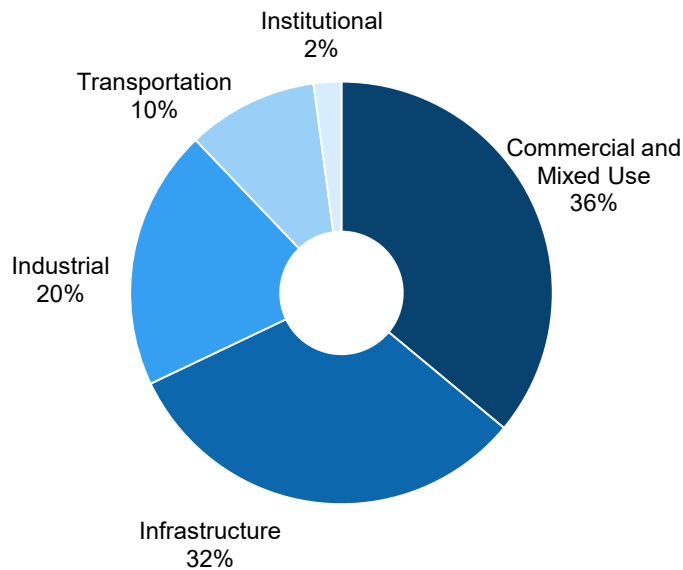
U.S. megaproject segmentation and distribution of spending

U.S. planned projects show an increasing share of spending in western states and in infrastructure and transportation.

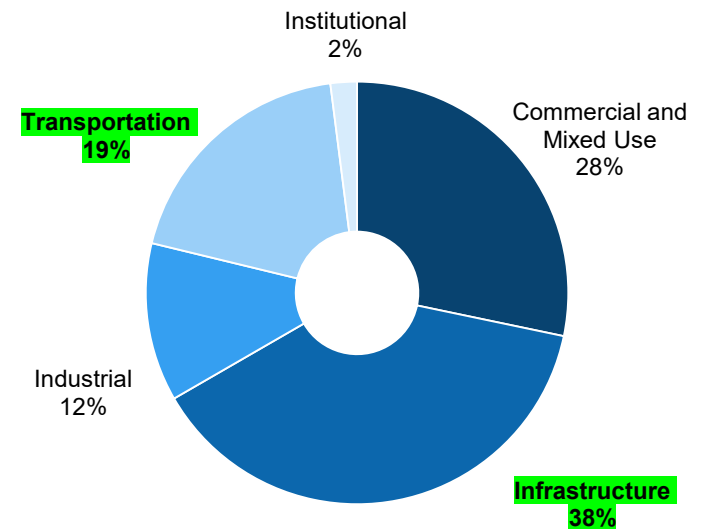
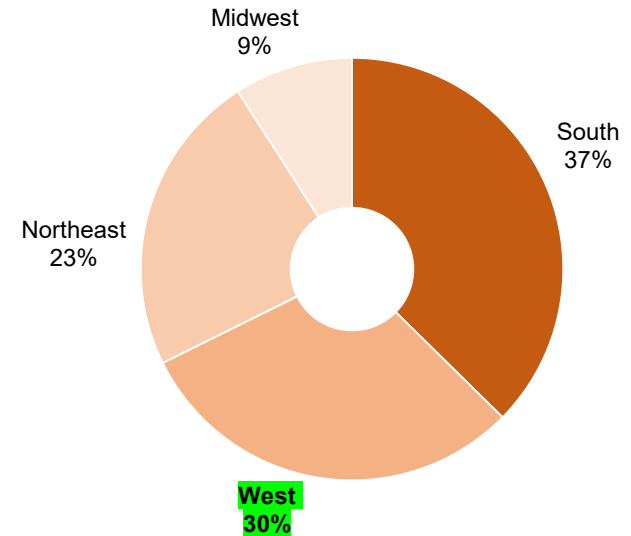
Past and underway projects
U.S., 2012-2018 \$ millions



Construction Segments



Upcoming projects in planning and design
U.S., 2019-2050 \$ millions

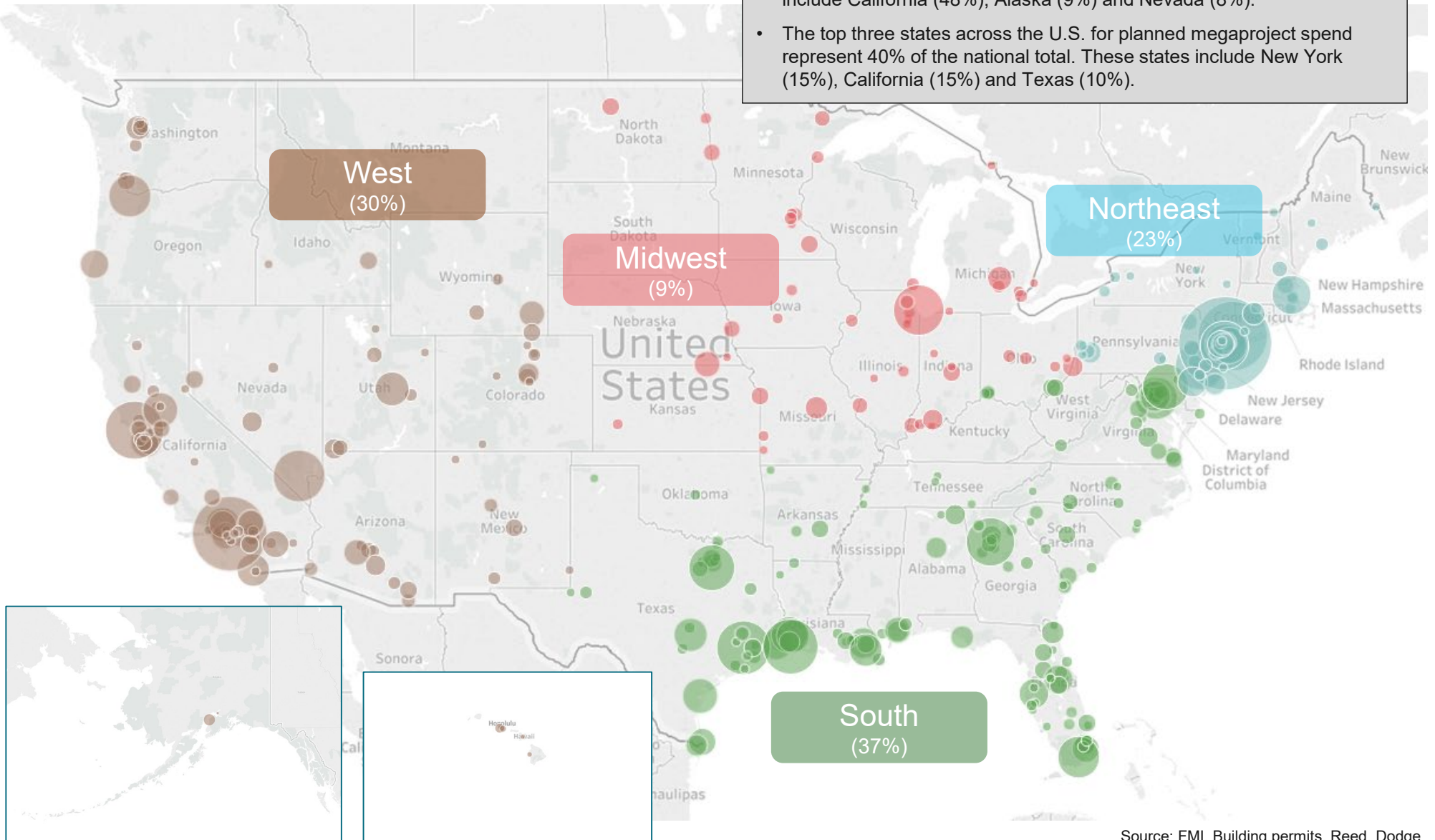


U.S. planned megaprojects by region

The South and the West Census regions are expected to represent the majority of planned megaproject spending across the U.S. at 37% and 30% of total, respectively.

Bubble size illustrates value of planned megaproject construction spending by county.

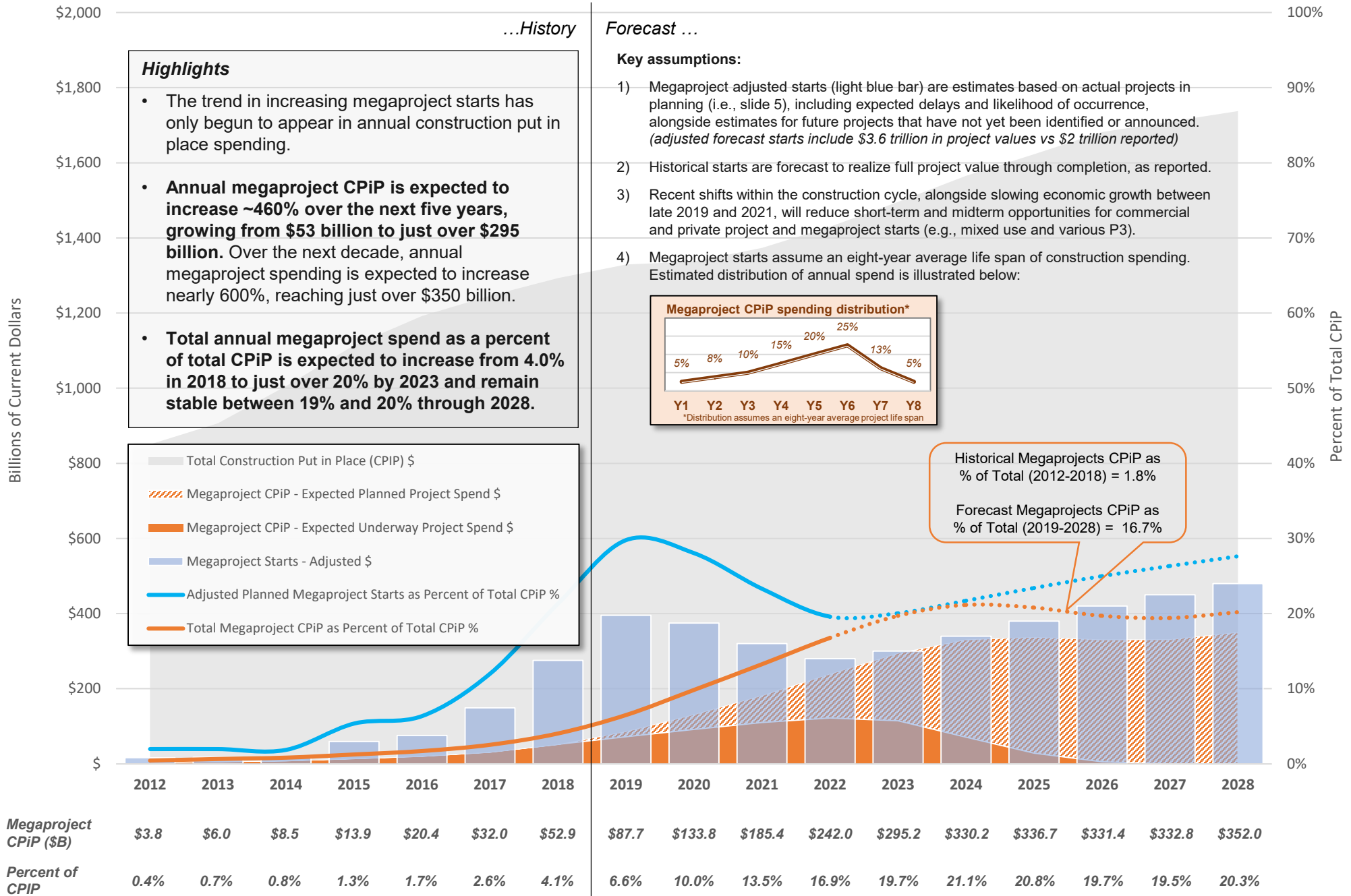
- Across the South significant states (by spend) include Texas (28%), Louisiana (17%) and Florida (16%). Across the West significant states include California (48%), Alaska (9%) and Nevada (8%).
- The top three states across the U.S. for planned megaproject spend represent 40% of the national total. These states include New York (15%), California (15%) and Texas (10%).



Source: FMI, Building permits, Reed, Dodge

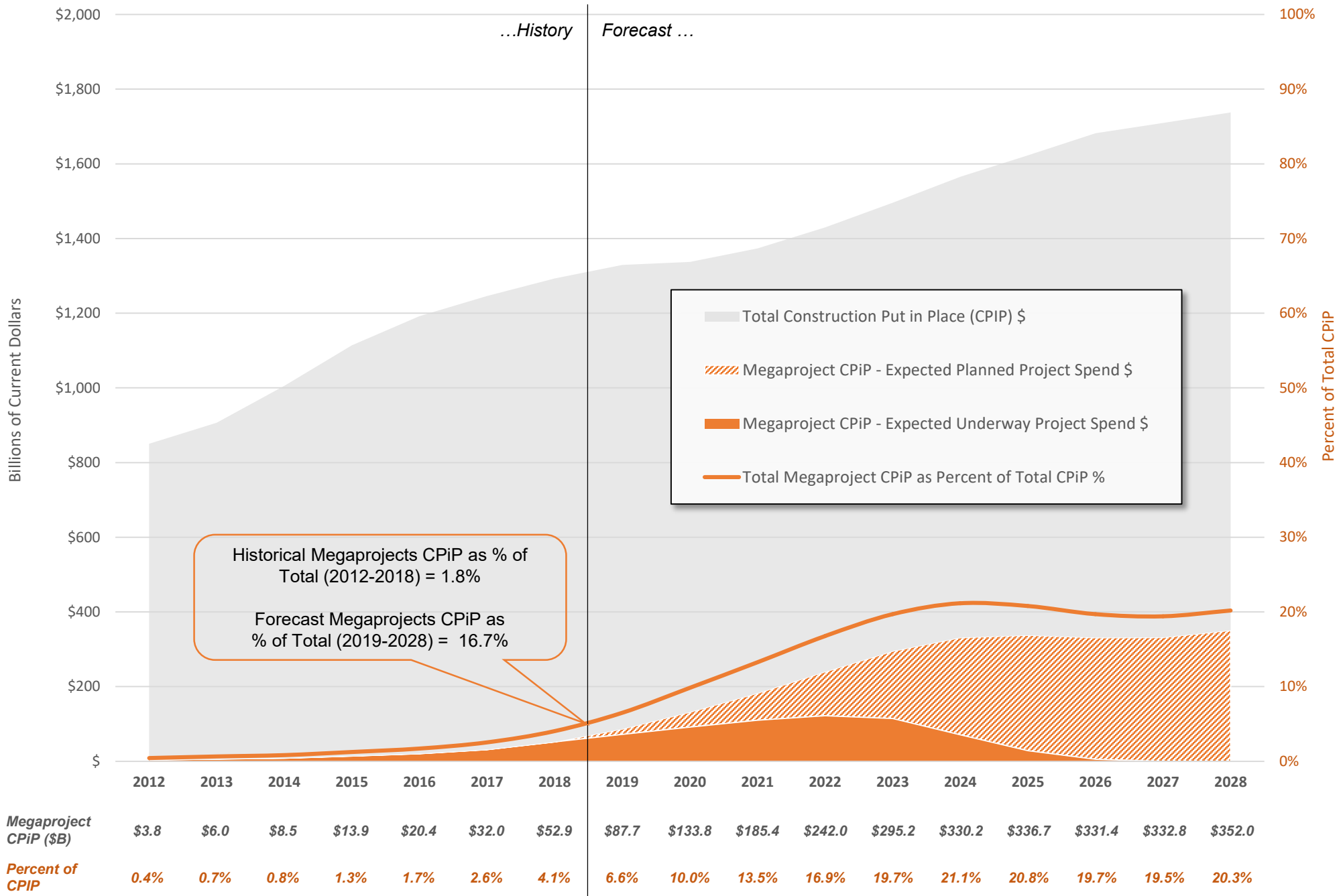
U.S. megaprojects, historical and planned activity

Construction put in place forecast, 2012-2028



U.S. megaprojects, historical and planned activity

Construction put in place forecast, 2012-2028



Canadian Megaproject Highlights

The average Canadian megaproject size is expected to increase 36%, from \$2.8 billion to \$3.8 billion, comparing awarded/historical projects between 2012 and 2018 with those in the forecast period between 2019 and 2023.

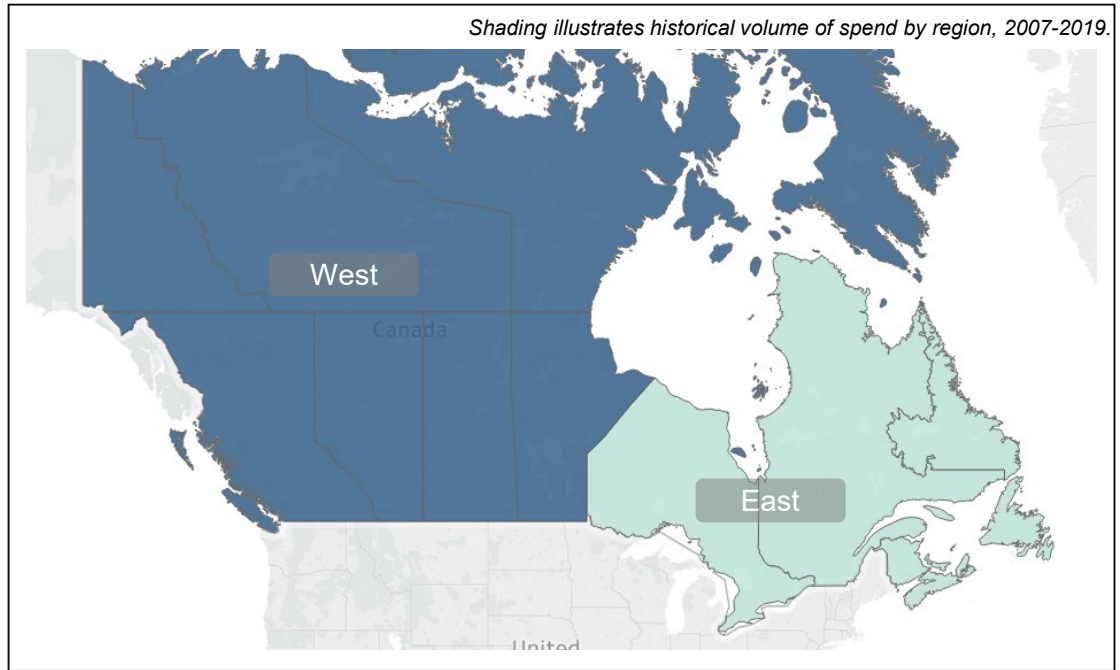
- Since 2012, 95 Canadian megaprojects have been awarded, representing \$272 billion in investment.
- FMI identified 153 Canadian megaprojects in planning, representing \$550 billion in investment.

The annual value of megaproject starts to CPiP in Canada has steadily increased from 7% in 2012 to just under 17% in 2018 with year-over-year volatility tied to major industrial investments.

Canadian planned megaprojects show an increasing share of spending in western provinces and in industrial and commercial and mixed use segments.

- The West Canada provinces are expected to represent the majority, or 62% of total, of planned megaproject spending.
- Across the West significant provinces (by spend) include Alberta (47%) and British Columbia (41%). Across the East significant provinces include Quebec (40%) and Ontario (30%).
- The top three provinces across Canada for planned megaproject spend represent nearly 70% of the national total. These provinces include Alberta (29%), British Columbia (26%) and Quebec (15%).

Canada Regional Study Map:



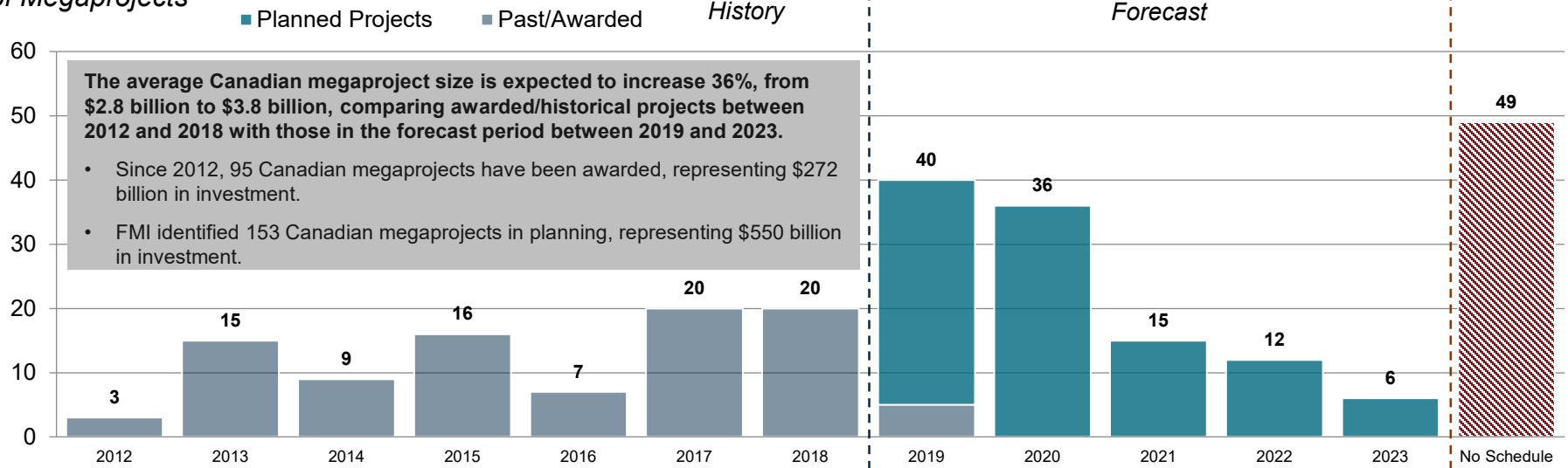
Largest Five Megaprojects, Past and Planned

Past Projects, 2007-2019 (\$B)		Planned Projects, 2019-2050 (\$B)	
Hebron Oil Platform, Newfoundland (2015)	\$14.0	Kitimat Clean Refinery, British Columbia (~2020)	\$22.0
Fort Hills Oil Sands Mine, Alberta (2014)	\$13.5	Frontier Oil Sands Mine Project, Alberta (~2019)	\$20.0
LNG Canada Export Terminal, British Columbia (2018)	\$10.0	Kwispaa LNG, British Columbia (~2020)	\$20.0
Cement Factory, Quebec (2015)	\$10.0	Ells River Oil Sands Facility, Alberta (~2021)	\$16.8
Kearl Oil Sands Expansion, Alberta (2013)	\$9.0	Eagle Spirit Oil Refinery and Pipeline, British Columbia (~2020)	\$14.0

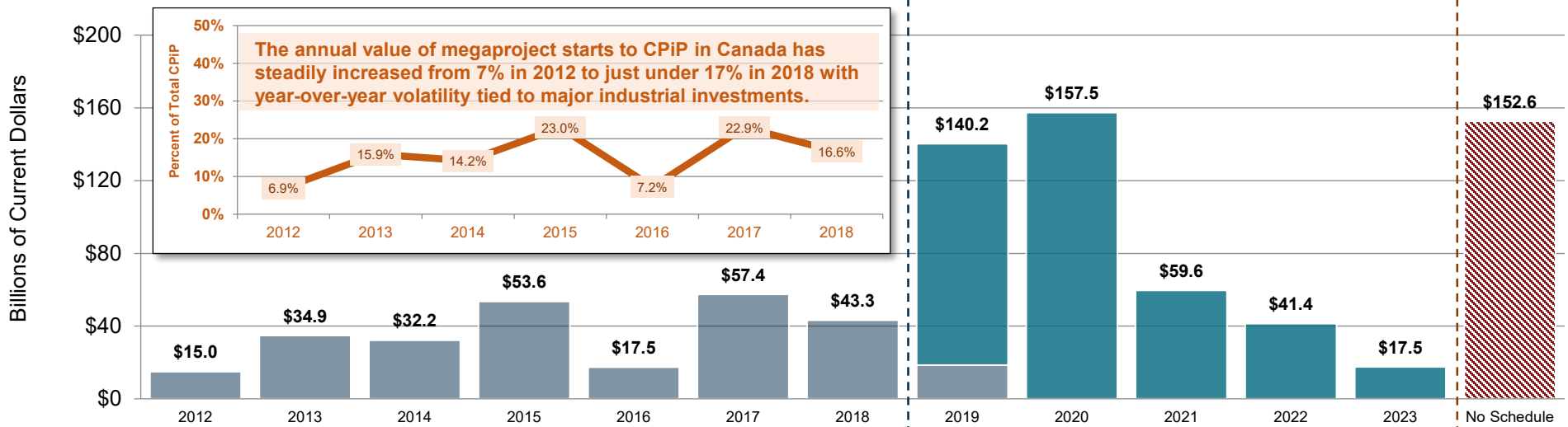
Source: FMI, Building permits, Reed, Dodge

Canadian Megaprojects

Count of Megaprojects



Value of Megaprojects



Average Project Size, Billions

\$5.0 \$2.3 \$3.6 \$3.3 \$2.5 \$2.9 \$2.2

\$2.8 (Full History)

\$3.8 (Full Forecast)

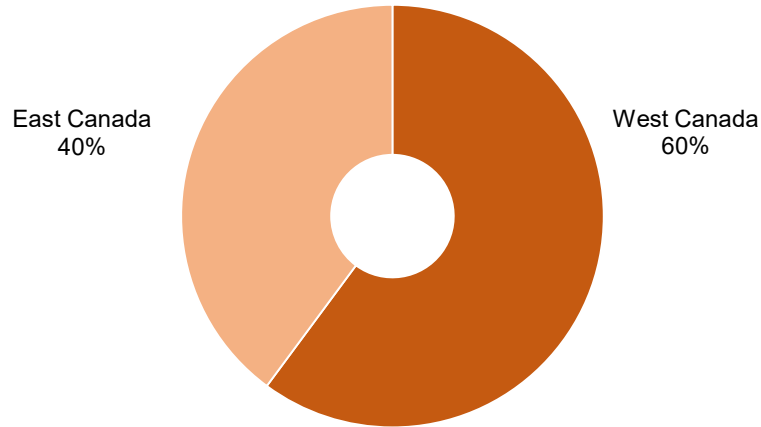
Megaproject segmentation and distribution of spending

Canadian planned megaprojects show an increasing share of spending in western provinces and in industrial and commercial and mixed use segments.

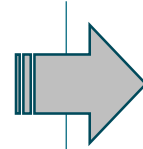
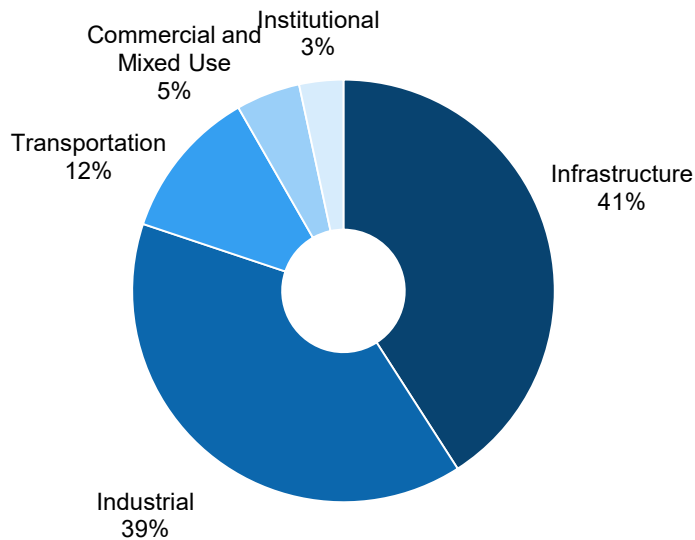
Past and underway projects

Canada, 2012-2019 \$ millions

Canadian Regions

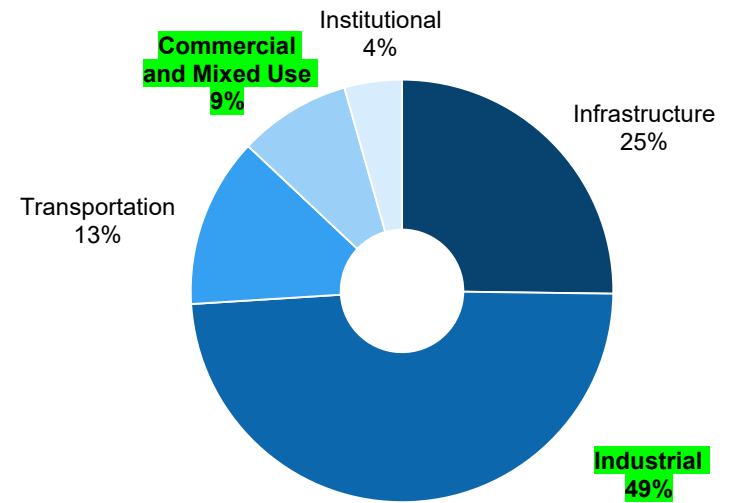
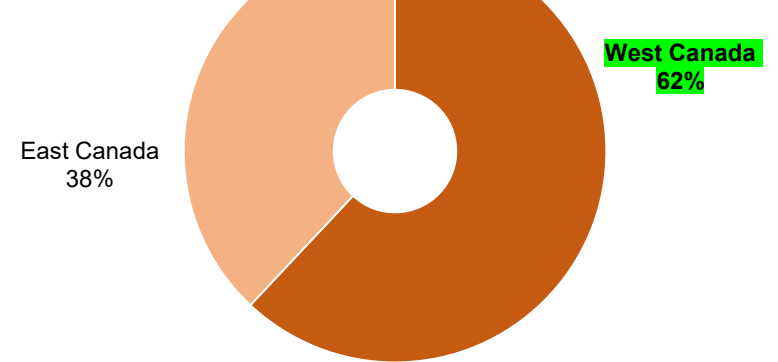


Construction Segments



Upcoming projects in planning and design

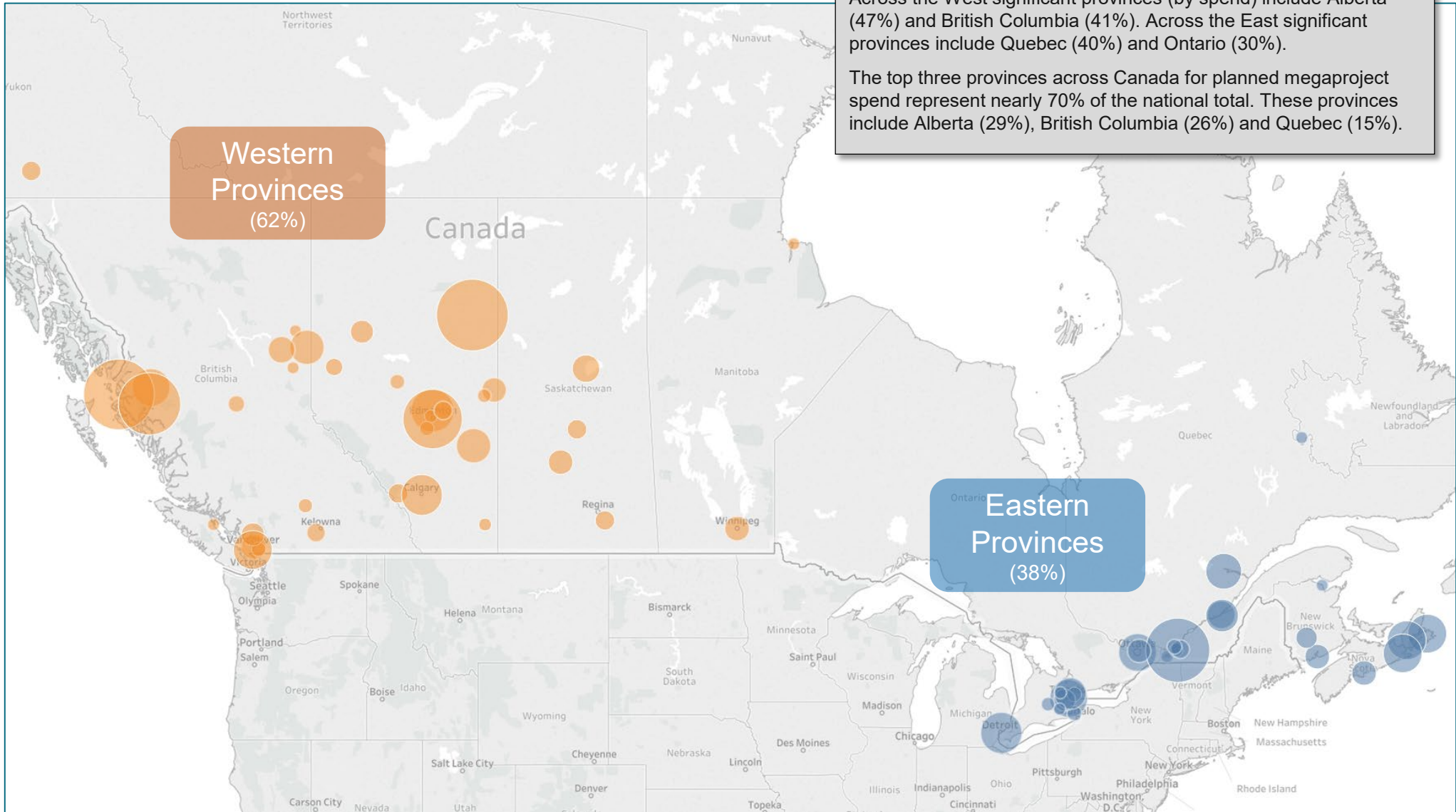
Canada, 2019-2050 \$ millions



Canadian planned megaprojects by region

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Bubble size illustrates value of planned megaproject construction spending by county.



Source: FMI, Building permits, Reed, Dodge



Brian Strawberry Senior Economist, FMI Corporation

Brian Strawberry is a senior economist with FMI. Brian's expertise is in economic and statistical modeling. He leads FMI's efforts in market sizing, forecasting and building product/construction material pricing and consumption trends. The combination of Brian's analytical skills and creative problem-solving abilities has proven valuable for many contractors, owners and private equity groups as well as industry associations and internal research initiatives.

Brian earned his Master of Business Administration degree from the University of North Carolina at Greensboro. He received his Bachelor of Science in business with a concentration in finance from Elon University.

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About FMI

FMI is the leading consulting and investment banking firm dedicated exclusively to the built environment.

FMI serves all sectors of the industry as a trusted advisor. More than six decades of context, connections and insights lead to transformational outcomes for our clients and the industry.

Sector Expertise

- Architecture, Engineering & Environmental
- Building Products
- Construction Materials
- Contractors
- Energy Service & Equipment
- Energy Solutions & Cleantech
- Specialty Chemicals
- Utility T&D