



WISCONSIN PUBLIC UTILITY INSTITUTE 2016

Future Trends & Tendencies

ECONOMIC SHIFTS UNDERWAY



Main Themes

- Industrial & Business Models are changing
- Business composition is changing
- Volatility conditions are accelerating and growing more complex
- The Input/Output Model in Commerce is Changing
- There will be significant impacts on resource utilization, energy in particular





Commerce
is
Changing



BUSINESS MODELS ARE CHANGING >

Moving from Space-Based Business to
Non-Spatial Business Networks

Platform	Company
B2B/B2C/Cloud Computing	Amazon
Social Networking/Combined Demographic Communities of Interest	Facebook, Twitter
Flash Services	Uber, AirBnB
Alternative Credit	CircleBack Lending
Branch-Free Banking	Ally Bank
Healthcare Telemedicine	Doctor-On-Demand, Inc.



BUSINESS MIX IS CHANGING



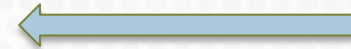
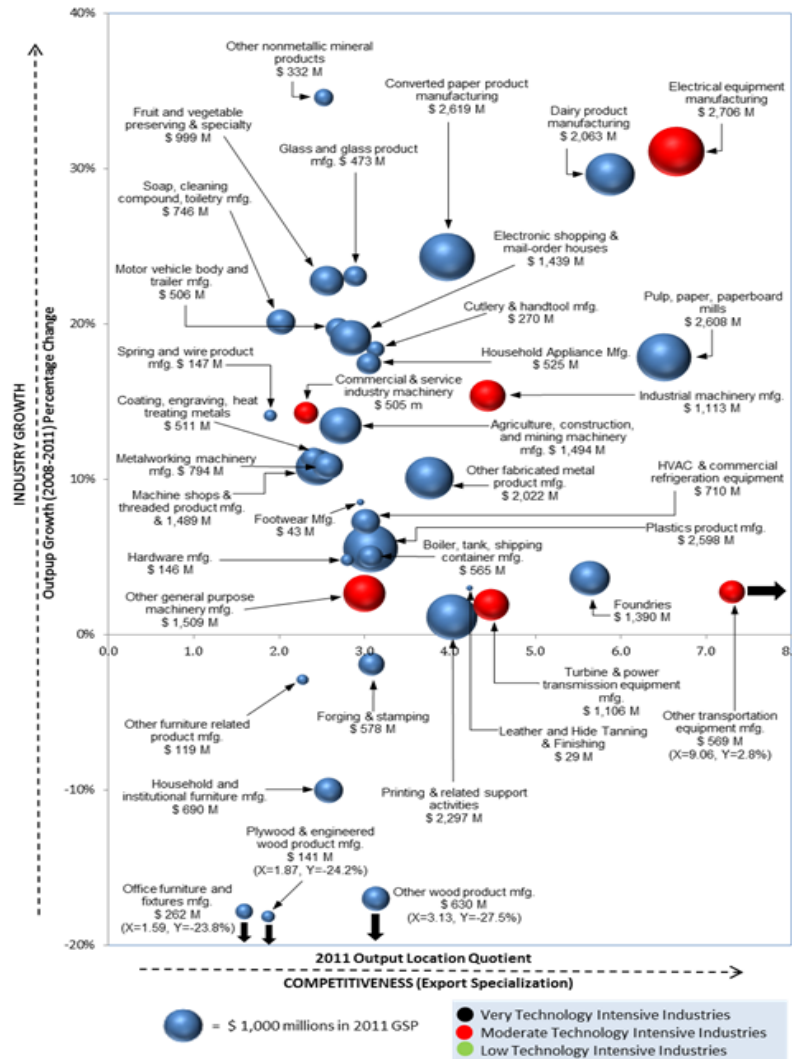
Challenged Industries	Thriving Industries
General Apparel Manufacturing	Telemedicine
Computer & Peripherals Manufacturing	Application Development
Non-Specialized Paper	Cloud Computing Services
Office Supply Manufacturing and Retailing	Consumer Staples and Discretionary
Oil & Gas Production and Services	Social Media
Mining & Coal Production	Organic & Specialty Food & Beverage
Publishing	Pet Care Products
Institutional Education	Specialty Apparel
Conventional retail	Alternative Educational Delivery



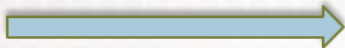
SOME DO BETTER, SOME WORSE



Figure 5-1 Overview of Wisconsin's Statewide Drivers



Better



Worse



RETAIL INDUSTRY PRESSURE





Volatility
Rising
&
Steepening



MARKET VOLATILITY



\$VIX Volatility Index - New Methodology INDX

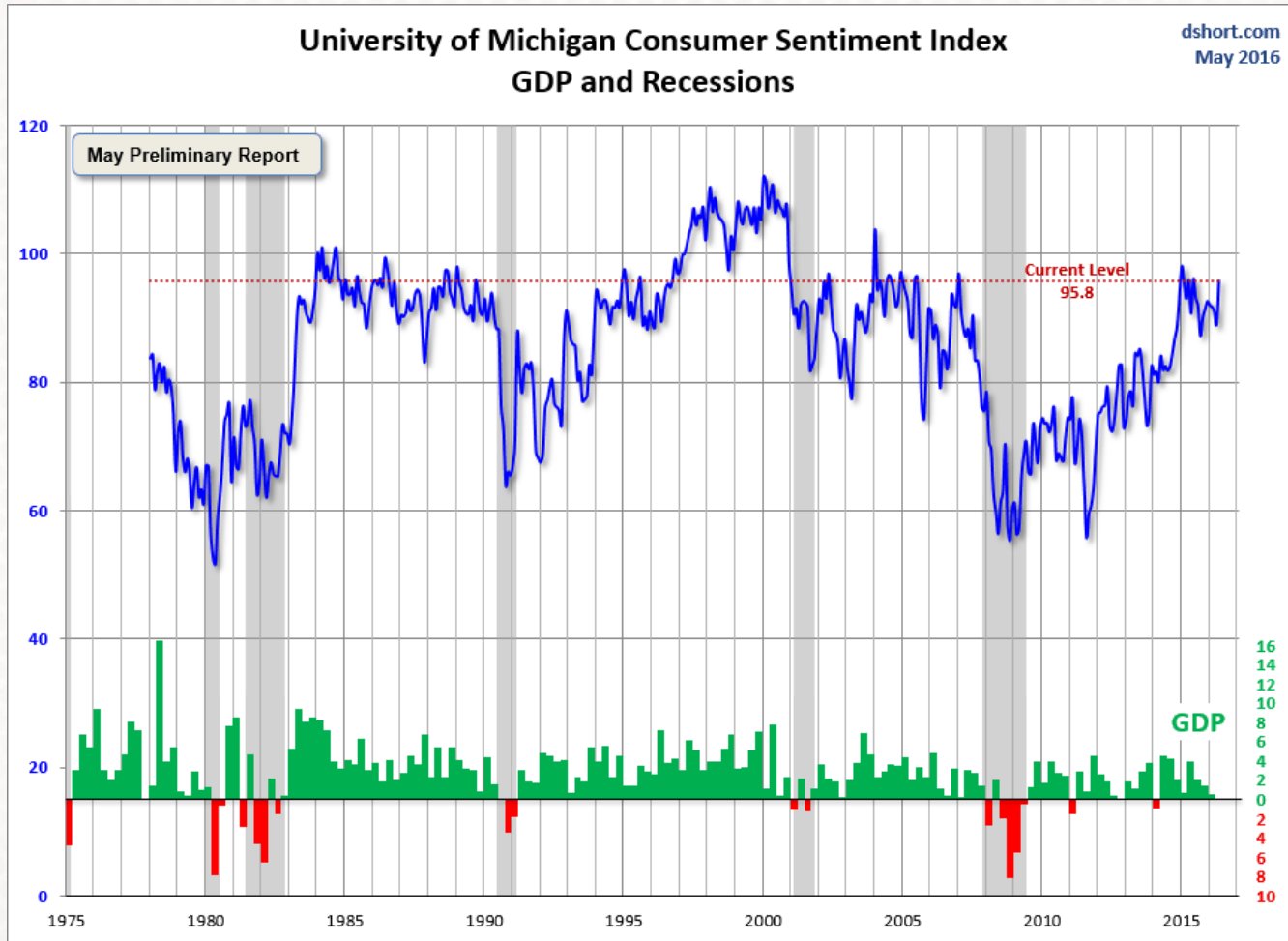
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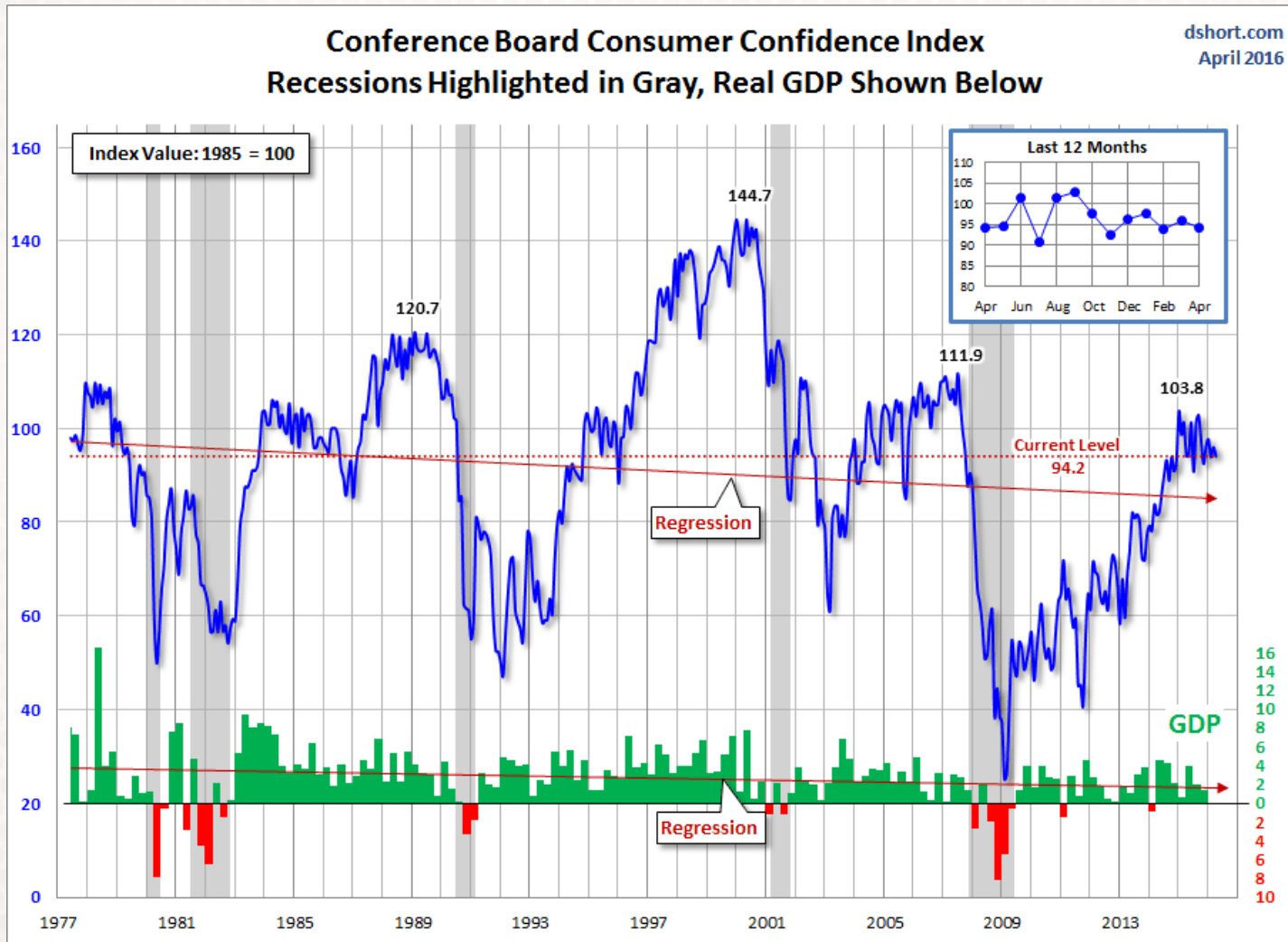
Open 25.40 High 27.59 Low 25.21 Last 26.05 Chg -0.97 (-3.59%) ▼



US BUSINESS CONFIDENCE



CONSUMER CONFIDENCE

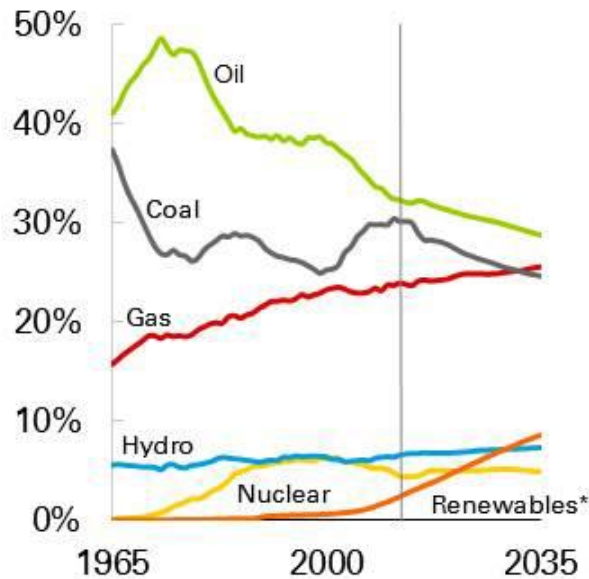


RECENT DEMAND PATTERNS SHIFT >

The fuel mix is set to change significantly...



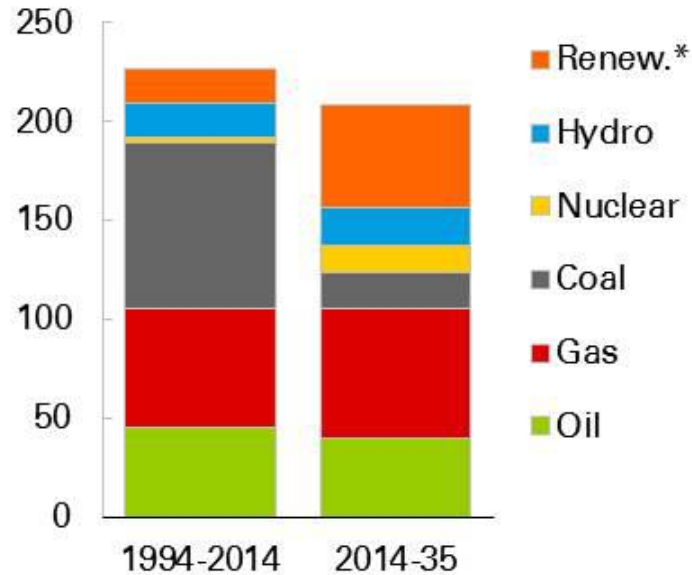
Shares of primary energy



* Includes biofuels

Annual demand growth by fuel

Mtoe per annum



Source: 2016 Energy Outlook



BUT INTENSITY FALLING



US Energy Intensity

Total Primary Energy Consumption per Dollar of GDP (Btu per Year 2005 U.S. Dollars)

2007	2008	2009	2010	2011	% Chg
7672	7544	7415	7463	7328	-4.5%





US Per Capita Energy Use 2000-2011 (Mln BTU per person)

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	% Chg
350	337	339	338	342	339	334	336	327	308	315	313	-10%



SEEDS OF CHANGE



- Dramatically changing outlook for coal power
- Energy scarcity and environmental impacts key drivers of evolution
- The emergence of renewable technologies as large-scale, cost-competitive energy sources
- A growing focus on off-grid approaches to expanding energy access
- A surge in natural gas use, often replacing coal
- Advances in energy efficiency, with significant untapped potential

The New Climate Economy, Global Commission on the Economy
and Climate



ENERGY SOURCE/DEMAND DYNAMICS CHANGING



- An energy sector transition is underway in many parts of the world. Policies to support the transition are increasingly being adopted
- Record High 30 GW installation of renewables capacity in the power sector in 2014. Renewables secured position as the second-largest source of electricity, behind coal.
- Energy efficiency improvements helped restrain the growth in final energy demand in 2014 to just one-third of the level it would otherwise have been.
- The coverage of energy efficiency regulations in industry, buildings and transport has nearly doubled, rising from 14% of the world's energy consumption in 2005 to 27% in 2014

Source: *World Energy Outlook 2015*, International Energy Agency



SOURCE & TECHNOLOGY IMPLICATIONS: FOSSIL FUELS



SOURCE	TECHNOLOGY	IMPACTS
FOSSIL FUELS	Cleaner/ cheaper extraction technologies & processes	<ul style="list-style-type: none">▪ Declining coal extraction (effects on mining machinery)▪ Safer fossil fuel storage, transmission & transport
	Higher input/output conversion efficiency	<ul style="list-style-type: none">▪ Higher engine efficiencies (next generation)
	Higher extraction costs and complexities	<ul style="list-style-type: none">▪ Decreasing marginal returns will push to other energy sources



SOURCE & TECHNOLOGY IMPLICATIONS: SOLAR



SOURCE	TECHNOLOGY	IMPACTS
SOLAR	Next Generation Photovoltaic Cell	<ul style="list-style-type: none">▪ Next generation materials▪ Lower per unit costs
	Storage technologies	<ul style="list-style-type: none">▪ Advanced materials discovery & deployment▪ Raise conversion efficiency from 15% to 40%
	Distributed collection networks	<ul style="list-style-type: none">▪ Solar-to-microwave Conversion (?)



SOURCE & TECHNOLOGY IMPLICATIONS: ADVANCED STORAGE



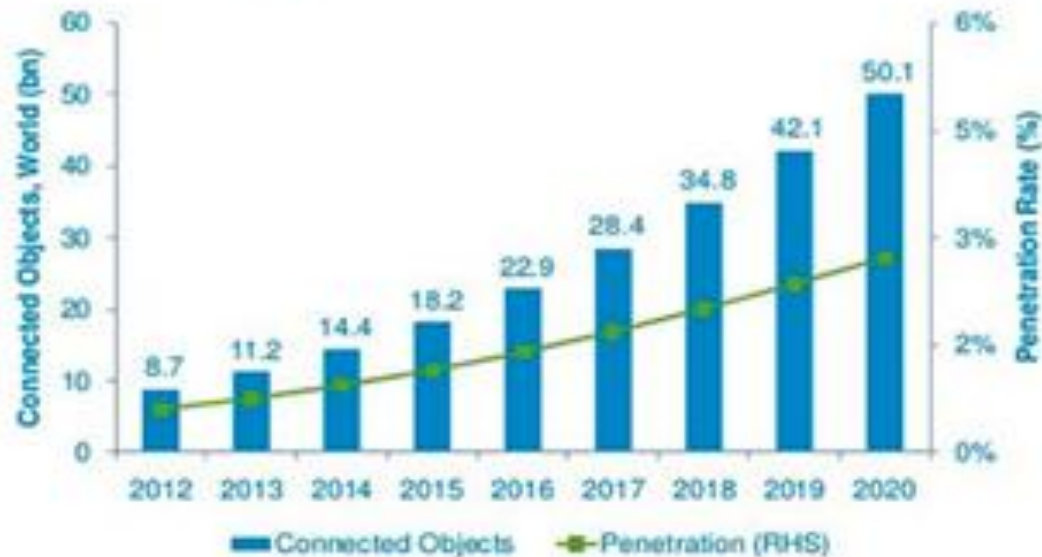
SOURCE	TECHNOLOGY	IMPACTS
ADVANCED STORAGE	New electrochemical storage mediums	<ul style="list-style-type: none">Higher capacity and longer charge life
	Large scale storage grids for off-peak management	<ul style="list-style-type: none">Advanced materials discovery & deploymentSpur micro-grid development
	Battery management systems	<ul style="list-style-type: none">Next generation software tools for monitoring and management
	New supercapacitor technologies	<ul style="list-style-type: none">Energy savings of 35%+



IOT AND ENERGY: UNAVOIDABLE COLLISION



Number of Connected Objects Expected to Reach 50bn by 2020

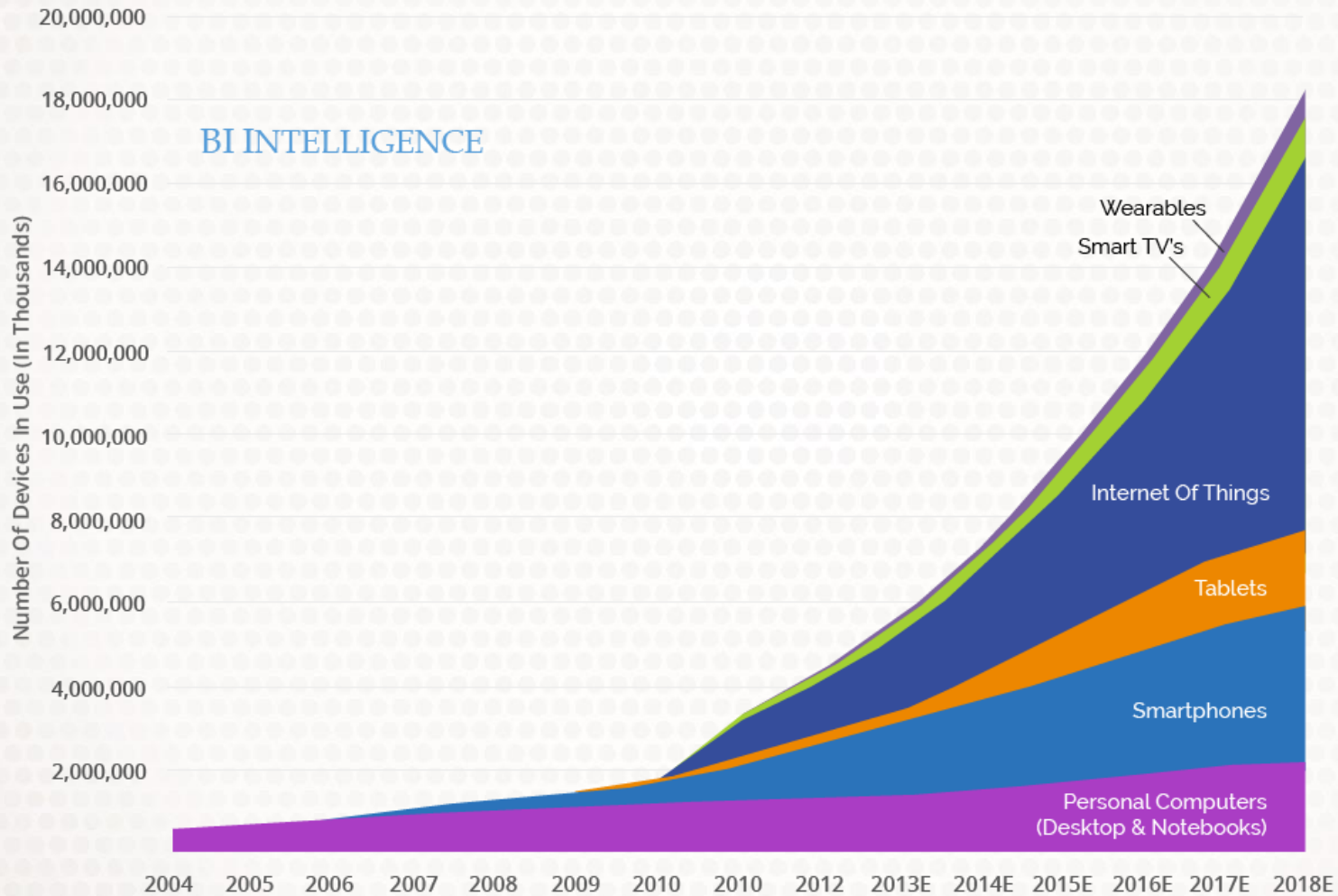


Penetration of connected objects in total 'things' expected to reach 2.7% in 2020 from 0.6% in 2012

Source: CCS, 2013



IOT TO CONSUME MOST CONNECTED CAPACITY





END

