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Garden City Friends of STEM
Science · Technology · Engineering · Math

Garden City Pineapples FLL Team

Presented by Matt Wakeham, rookie parent coach

- 6 – sixth graders
- 2 – fifth graders
- 1 – fourth grader
- 5 girls / 4 boys

Thank you to our primary and secondary sponsors

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MATHNASIUM
The Math Learning Center

FIRST Lego League

- Every year FLL releases a Challenge, which is based on a real-world scientific topic
- Core Values
- Research Project
- Robot Design
- 3 - Two and a half minute rounds

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The Core Values

The Core Values are the heart of *FIRST*® LEGO® League. By embracing the Core Values, participants learn that friendly competition and mutual gain are not separate goals, and that helping one another is the foundation of teamwork. Review the Core Values with your team and discuss them whenever they are needed.

- We are a team.
- We do the work to find solutions with guidance from our coaches and mentors.
- We know our coaches and mentors don't have all the answers; we learn together.
- We honor the spirit of friendly competition.
- What we discover is more important than what we win.
- We share our experiences with others.
- We display Gracious Professionalism® and Coopertition® in everything we do.
- We have FUN!

The Core Values Poster

The Core Values poster is designed to help the Core Values Judges at your tournament learn more about your team and its unique story.

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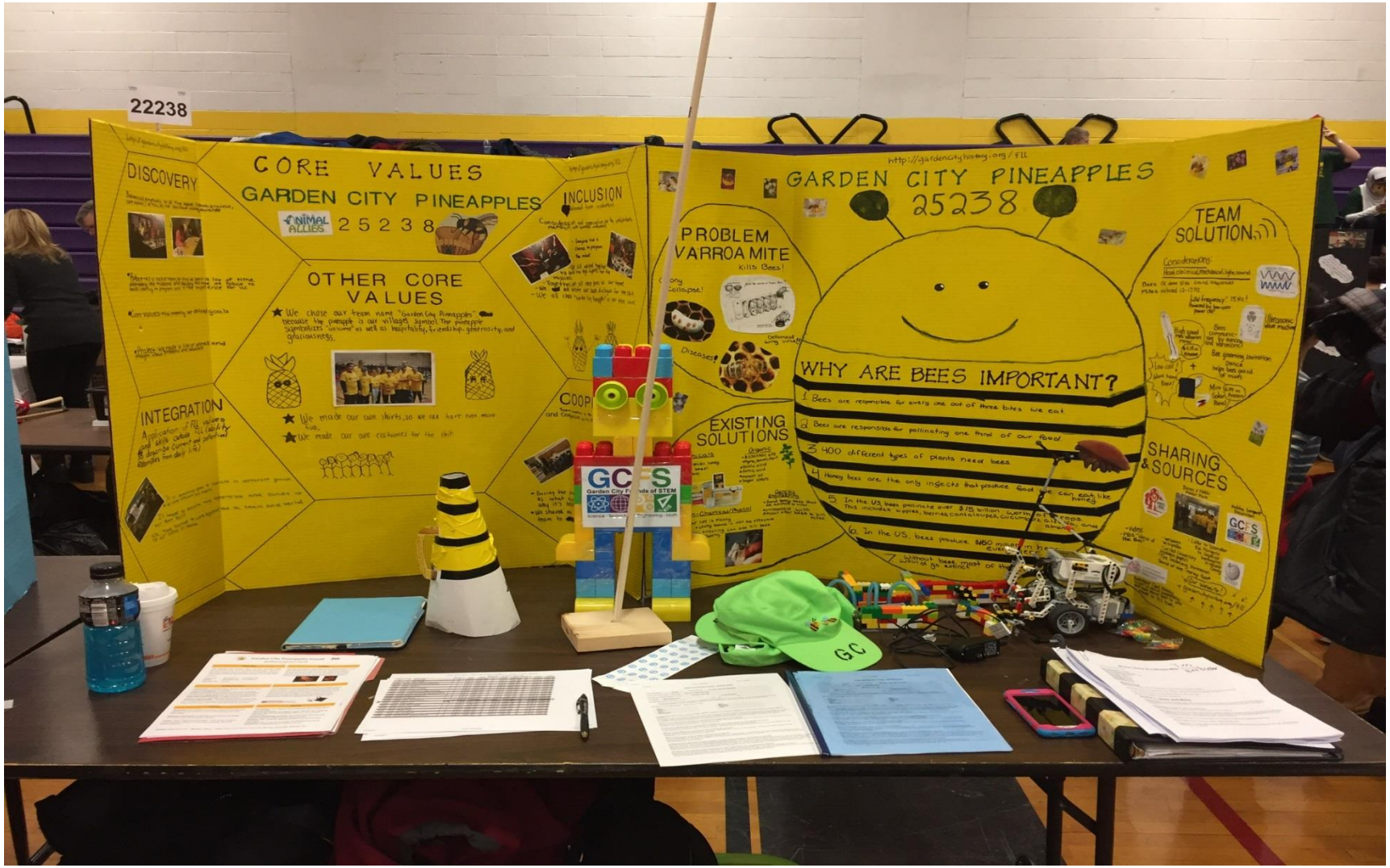
Core Values



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Research Project

As a Team – Choose an animal. It might be an animal that lives in your home or neighborhood. It might be an animal that you have seen at a zoo, aquarium, or farm. It might be an animal that lives in the forest, ocean, desert or another habitat.

Learn about the ways people interact with this type of animal. (People must interact with this animal in some way to be valid for ANIMAL ALLIES℠.) Ask questions like:

- When people interact with your animal, is it on purpose or by accident?
- Does the interaction help or hurt people, the animal, or both?
- What type of professionals work with or study your animal?
- Do you notice any ways that the interaction could be better – more productive, healthier, or happier for either the person or the animal? Look for these problems as you research.

This might be a great time for the team to interview a professional. The professional could be someone who works directly with animals or researches animal problems for his or her job. Can a professional help your team learn about animal health, safety, enrichment, or living environments?

As a Team – Identify a specific problem with the way people interact with your animal. You might select a problem in one of these areas (or add your own):

- Animals accidentally harmed by an activity that helps people
- Recreating a natural living environment inside human-made buildings
- Feeding
- Finding the right enrichment activities for a specific animal
- Healing injured or sick animals
- Managing feces
- Natural animal instincts accidentally harming people
- Conserving endangered species
- Transportation

In the ANIMAL ALLIES℠ Challenge, an *animal* is any member of the scientific animal kingdom (besides humans) that is currently alive today.

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DESIGN A SOLUTION

Next, your team will design a solution to the problem. Any solution is a good start. The ultimate goal is to design an **innovative** solution that adds value to society by improving something that already exists, using something that exists in a new way, or inventing something totally new.

As a Team – Think about:

- What could be done better? What could be done in a new way?
- Could your solution make people and animals more productive, healthier, or happier?
- How can you reimagine the way we work with or study animals?
- Could you use an adaptation from an existing animal (biomimicry) to help solve the problem you identified?

Ask your team to think of your problem like a puzzle. Brainstorm! Then turn the problem upside down and think about it in a completely different way. Imagine! Get silly! Even a "silly idea" might inspire the perfect solution. Encourage team members to try one idea (or more), but be prepared that the first idea may need some improvements.

Make sure your team thinks about how they could make their solution a reality. Try asking them questions like:

- Why would your solution succeed when others have failed?
- What information would you need to estimate the cost?
- Do you need any special technology to make your solution?
- Who would be able to use it?

Remember, your team's solution does not need to be completely new. Inventors often improve an idea that already exists or use something that exists in a new way.

A great solution might be a device or technology, but maybe not. Look for the solution that the team thinks will solve the problem best. Team members should be prepared to tell the judges what makes their idea better than the existing solutions.

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Why are honey bee colonies being reduced? What can be done to preserve them?

We researched & identified a major cause: Varroa Mites bringing viruses that collapse colonies!

Suggested solution: low frequency vibrations may mitigate the mites from entering while not effecting the bees ….

Garden City Pineapples #25238

gardencityhistory.org/fll

Honey Bees

We choose the Honey Bees as our Animal Allies because there are many benefits of the bees. They are the only insects that produce food eaten by humans. They help pollinate plants that we eat on a daily basis such as:

Almonds
Apples
Blackberries
Blueberries
Strawberries
Honey
Cranberries
and others!

Problem

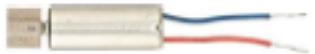
We are working to save bees from Varroa Mites. They feed off the bee's blood and fat. Without bees, we would not have crops to eat and oxygen to inhale. Varroa Mites kills bees, brings diseases such as the Deformed Wing Virus, and causes colony collapse.

Existing Solutions

Chemicals – Contaminates honey, are bad for bees, and are dangerous to apply.
Organic Chemicals – Essential oils such as thyme, lemon and mint, oxalic acid, sugar esters and others are hard to apply and may not always be effective.
Non-Chemical/Physical – Sugar roll on the bees is a messy process. Heating can also kill bees.
Genetic Engineering – You can breed honey bees that are resistant to mites or crossbreed with African killer bees to kill mites, but they can also attack humans.

Solution

Honeybees don't have hearing but they can detect sound from vibration. They are bothered by sound frequencies from 2 – 8 Hz. Varroa Mites are irritated from 12 – 17 Hz. Our solution is to create a noise 12 – 17 Hz that will drive the mites out of the bee hive. We will use mini solar panels for energy and high speed mini vibration motor, both can be found on Amazon.com for a cheap price.



Sources

Beekeeper: Karl Faltow at Cornell Cooperative Extension Nassau County taught us about beekeeping and facts about bees.

Websites: Wikipedia, University of Maryland, Indiegogo, and many other beekeeping websites

Videos: PBS's "Silence of the Bees", "Life cycle of Varroa mites and their effect on honey bee colonies" by NOD Apiary Products.

Sharing

Beekeeper: We talked to the beekeeper Karl Faltow about our solution.
Barnes and Noble mini Maker Faire: We set up a table for Garden City Friends of STEM to share our FLL robotic experiences.
Garden City Friends of STEM: We shared our website with GCFS's Facebook page and executive director.
Website: We created a website to share our project with the public.
Lawmaker: We wrote to lawmaker Ed Mangano to ask for legalization of beekeeping in Nassau County.

The Project Presentation

Any inventor must present their idea to people who can help them make it a reality, such as engineers, investors, or manufacturers. Like adult inventors, the Project presentation is your team's chance to share their great Project work with the Judges.

All regions require teams to prepare a Project presentation. As long as your team covers the basic Project information, they may choose any presentation style they like. Check with your tournament organizer to see if there are any size or noise restrictions in the judging rooms.

Your team's presentation may include posters, slideshows, models, multimedia clips, props, costumes, and more. Creativity in the presentation is rewarded, but covering all of the essential information is even more important.

Teams will only be eligible for Project awards if they:

- Identify a **problem** that meets this year's criteria.
- Explain their **innovative solution**.
- Describe how they **shared with others** prior to the tournament.

Presentation requirements:

- All teams must present **live.** The team may use media equipment (if available) only to enhance the live presentation.
- **Include all team members.** Each team member must participate in the Project judging session.
- Set up and complete the presentation in **five minutes or less** with no adult help.

The teams who excel at tournaments also use the Project presentation to tell the Judges about their sources of information, problem analysis, review of existing solutions, elements that make their idea innovative, and any plans or analysis related to implementation.

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Project Presentation: movie skit ……

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Robot Design Executive Summary

An "executive summary" is often used by engineers to briefly outline the key elements of a product or project. The purpose of the Robot Design Executive Summary (RDES) is to give the Robot Design Judges a quick overview of your team's robot and all that it can do.
Unlike the Core Values Poster, teams do not need to create a poster or written material for the RDES. However, if the team would like to share pictures of the design process, records of strategy sessions, or examples of programming (either printed or on a laptop), the RDES presentation is an appropriate time.

Some regions require all teams to prepare a Robot Design Executive Summary, while others do not. Either way, the RDES is a great tool to help your team organize their thoughts about the robot and the design process they used. Check with your tournament organizer to see if your team is expected to present your RDES in the Robot Design judging session.

Have your team prepare a short presentation (no longer than four (4) minutes) covering the elements below:

1. **Robot Facts**: Share a little bit about your robot, such as the number and type of sensors, drivetrain details, number of parts, and the number of attachments. The Judges also like to know what programming language your team used, the number of programs, and the Robot Game mission where your team had the most success.
2. **Design Details**:
   a. **Fun**: Describe the most fun or interesting part of robot design as well as the most challenging parts. If your team has a fun story about your robot please feel free to share.
   b. **Strategy**: Explain your team's strategy and reasoning for choosing and accomplishing missions. Talk a little bit about how successful the robot was in completing the missions that were chosen.
   c. **Design Process**: Describe how your team designed their robot and what process they used to make improvements to the design over time. Briefly share how different team
   d. **Mechanical Design**: Explain the robot's basic structure. Explain to the Judges how the robot moves (drivetrain), what attachments and mechanisms it uses to operate or complete missions, and how your team makes sure it is easy to add/remove attachments.
   e. **Programming**: Describe how your team programmed the robot to ensure consistent results. Explain how the team organized and documented programs. Mention if the programs use sensors to know the location of the robot on the field.
   f. **Innovation**: Describe any features of the robot's design that the team feels are special or clever.
3. **Trial Run**: Run the robot briefly to demonstrate how it completes the mission(s) of your team's choice. Please do not do an entire robot round. The Judges need time to ask questions after the RDES.

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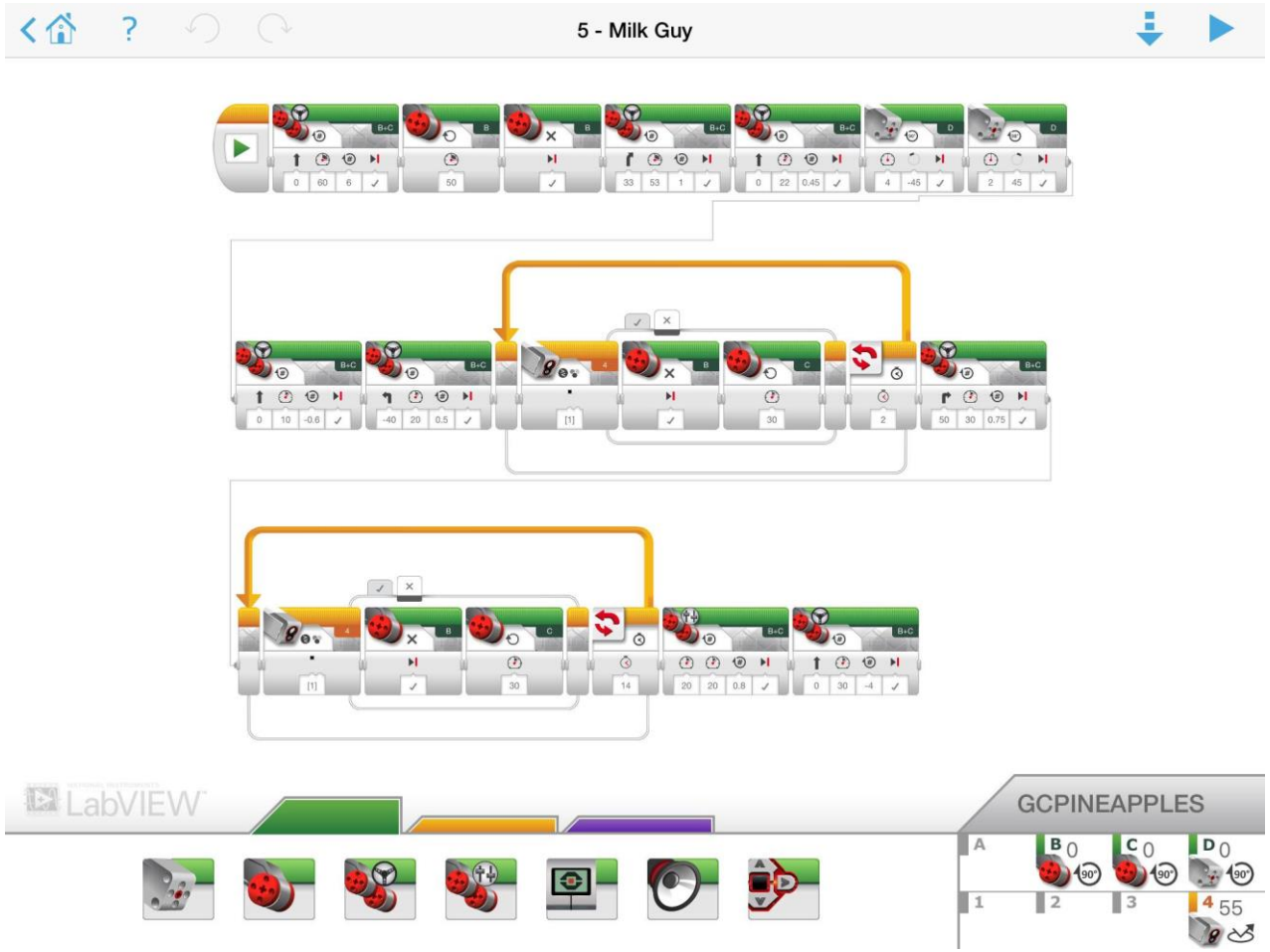
- Engineer's notebook to reference codes for each robot mission

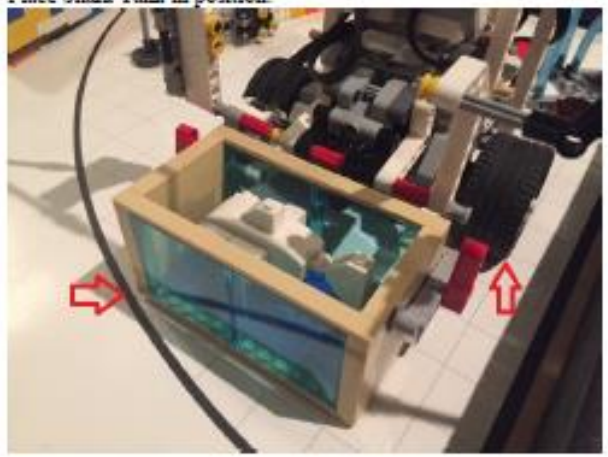


Garden City Pineapples
Team 25238
(Total Points possible **139 Points**, or **179** if other team does Animal Conservation)

Run #1 – Shark Tank (30 Points) **DO NOT REDO!**
Preparation and pushing shark tank to place.

1. Put a manure on the loop holder (do this for 2 manure)

2. Place Shark Tank in position.



The Robot Game

The Robot Game Rules

GUIDING PRINCIPLES

GP1 – Gracious Professionalism® - You are "Gracious Professionals." You compete hard against problems, while treating all people with respect and kindness. If you joined *FIRST®* LEGO® League with a main goal of "winning a robotics competition," you're in the wrong place!

GP2 – Interpretation

- **If a detail isn't mentioned, then it doesn't matter.**
- Robot Game text means exactly and only what it plainly says.
- If a word isn't given a game definition, use its common conversational meaning.

GP3 – Benefit of the Doubt - If the Referee (Ref) feels something is a "very tough call," and no one can point to strong text in any particular direction, you get the Benefit Of The Doubt. This good-faith courtesy is not to be used as a strategy.

GP4 - Variability - Our suppliers and volunteers try hard to make all Fields correct and identical, but you should always expect little defects and differences. Top teams design with these in mind. Examples include Border Wall splinters, lighting changes, and Field Mat wrinkles.

GP5 - Information Superiority - If two official facts disagree, or confuse you when read together, here's the order of their authority (with #1 being the strongest):

#1 = Current Robot Game **UPDATES**
#2 = **MISSIONS** and **FIELD SETUP**
#3 = **RULES**
#4 = **LOCAL HEAD REF** - In unclear situations, local Head Referees may make good-faith decisions after discussion, with Rule GP3 in mind.

- Pictures and video have no authority, except when talked about in #1, #2, or #3.
- Emails and Forum comments have no authority.

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- Construct
  a 8’ x 4’ Table
- Field Mat is different every year based on project theme

- All mission objects are built from scratch by team members using Lego parts.

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The Robot

Robot parts:

- EV3 Controller
- Motors
- Sensors
- Lego parts to serve as arms, trays, scoops, whatever …..

R03 - Motors - You are allowed up to **four** individual motors in any particular Match.

- Each one must exactly match a type shown below.
- You may include more than one of a type, but again, your grand total may not be greater than FOUR.
- ALL other motors must be left in the Pit Area for that Match, **no exceptions**.

R04 - External Sensors - Use as many external sensors as you like.

- Each one must exactly match a type shown below.
- You may include more than one of each type.

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Tournament

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Take aways ….

- Team work
- Collaboration
- Research process
- Communication and Presentation skills
- Basic Coding
- Mechanical Engineering Basics
- Problem Solving
- Creativity ….

FIRST LEGO LEAGUE

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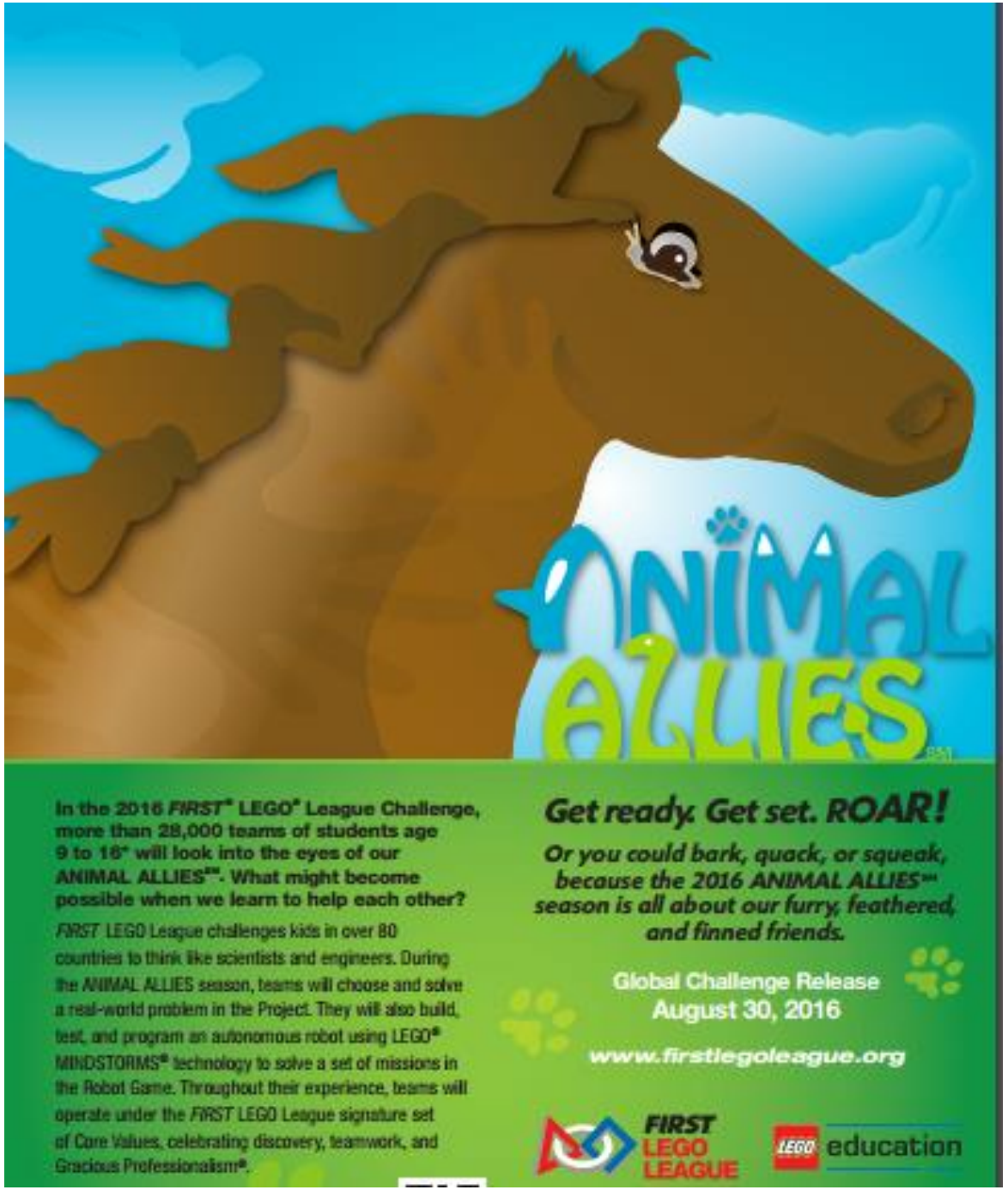

The future of STEM is The Future ….

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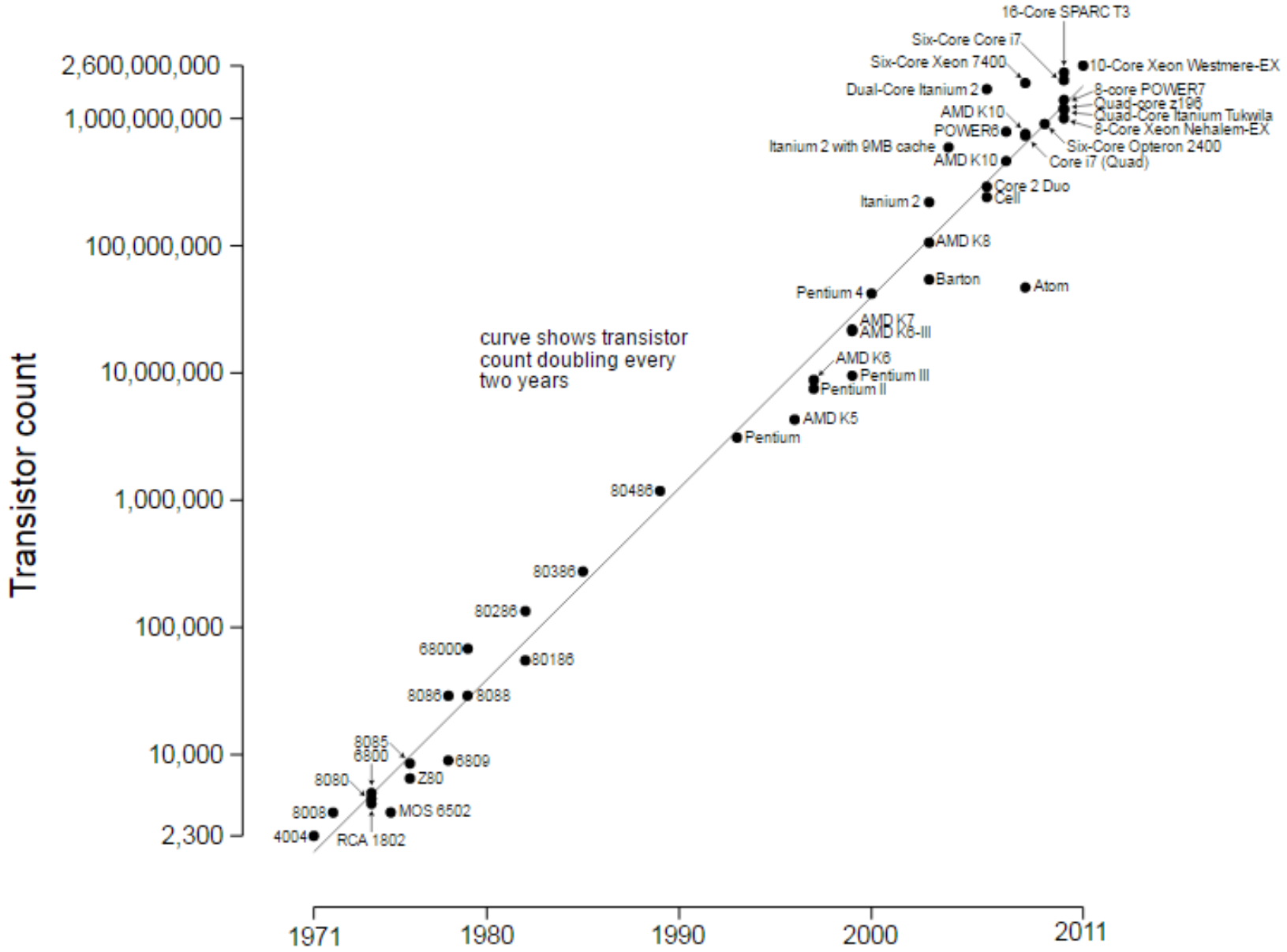
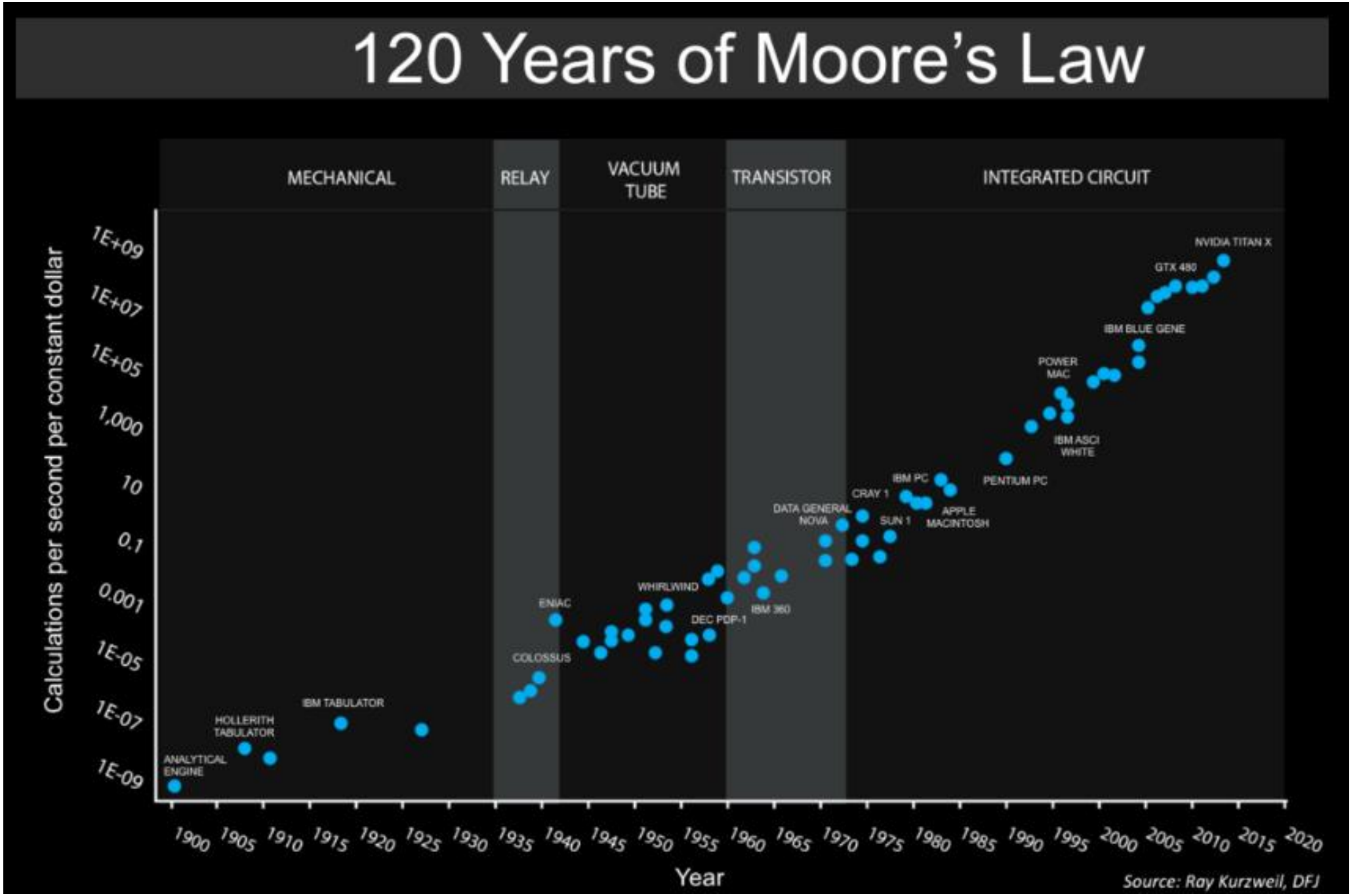
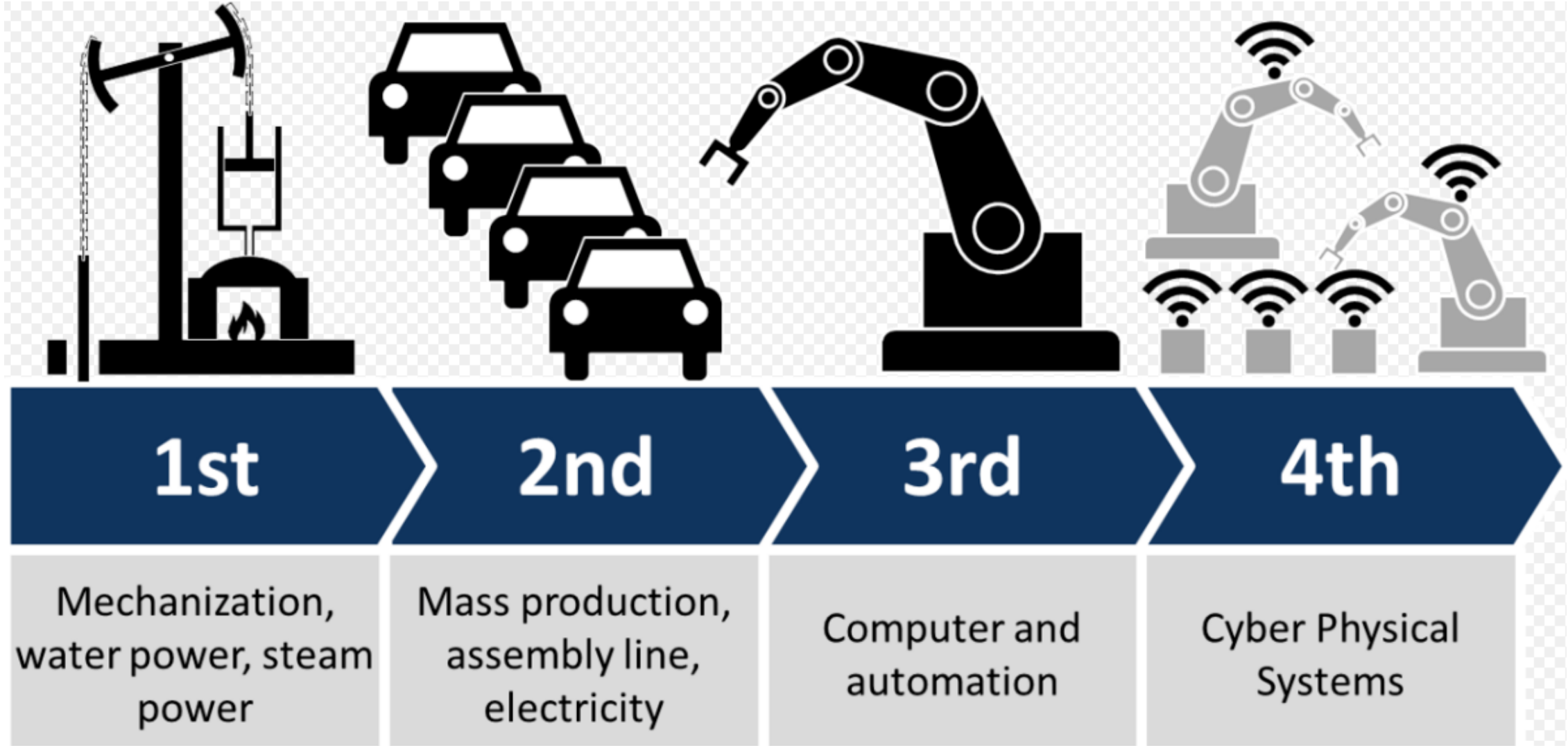
Microprocessor Transistor Counts 1971-2011 & Moore's Law




120 Years of Moore's Law
MECHANICAL
RELAY
VACUUM TUBE
TRANSISTOR
INTEGRATED CIRCUIT
Calculations per second per constant dollar
1E+09
1E+07
1E+05
1,000
10
0.1
0.001
1E-05
1E-07
1E-09
ANALYTICAL ENGINE
HOLLERITH TABULATOR
IBM TABULATOR
COLOSSUS
ENIAC
WHIRLWIND
DEC PDP-1
IBM 360
DATA GENERAL NOVA
CRAY 1
SUN 1
IBM PC
APPLE MACINTOSH
PENTIUM PC
POWER MAC
IBM ASCI WHITE
IBM BLUE GENE
GTX 480
NVIDIA TITAN X
1900 1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020
Year
Source: Ray Kurzweil, DFJ

Industry 4.0 – the Internet of Things, The Cloud, cyber, Artificial Intelligence, 3D printing and Virtual Reality ……



Twelve potentially economically disruptive technologies

Mobile Internet

Increasingly inexpensive and capable mobile computing devices and Internet connectivity

Automation of knowledge work

Intelligent software systems that can perform knowledge work tasks involving unstructured commands and subtle judgments

The Internet of Things

Networks of low-cost sensors and actuators for data collection, monitoring, decision making, and process optimization

Cloud technology

Use of computer hardware and software resources delivered over a network or the Internet, often as a service

Advanced robotics

Increasingly capable robots with enhanced senses, dexterity, and intelligence used to automate tasks or augment humans

Autonomous and near-autonomous vehicles

Vehicles that can navigate and operate with reduced or no human intervention

Next-generation genomics

Fast, low-cost gene sequencing, advanced big data analytics, and synthetic biology ("writing" DNA)

Energy storage

Devices or systems that store energy for later use, including batteries

3D printing

Additive manufacturing techniques to create objects by printing layers of material based on digital models

Advanced materials

Materials designed to have superior characteristics (e.g., strength, weight, conductivity) or functionality

Advanced oil and gas exploration and recovery

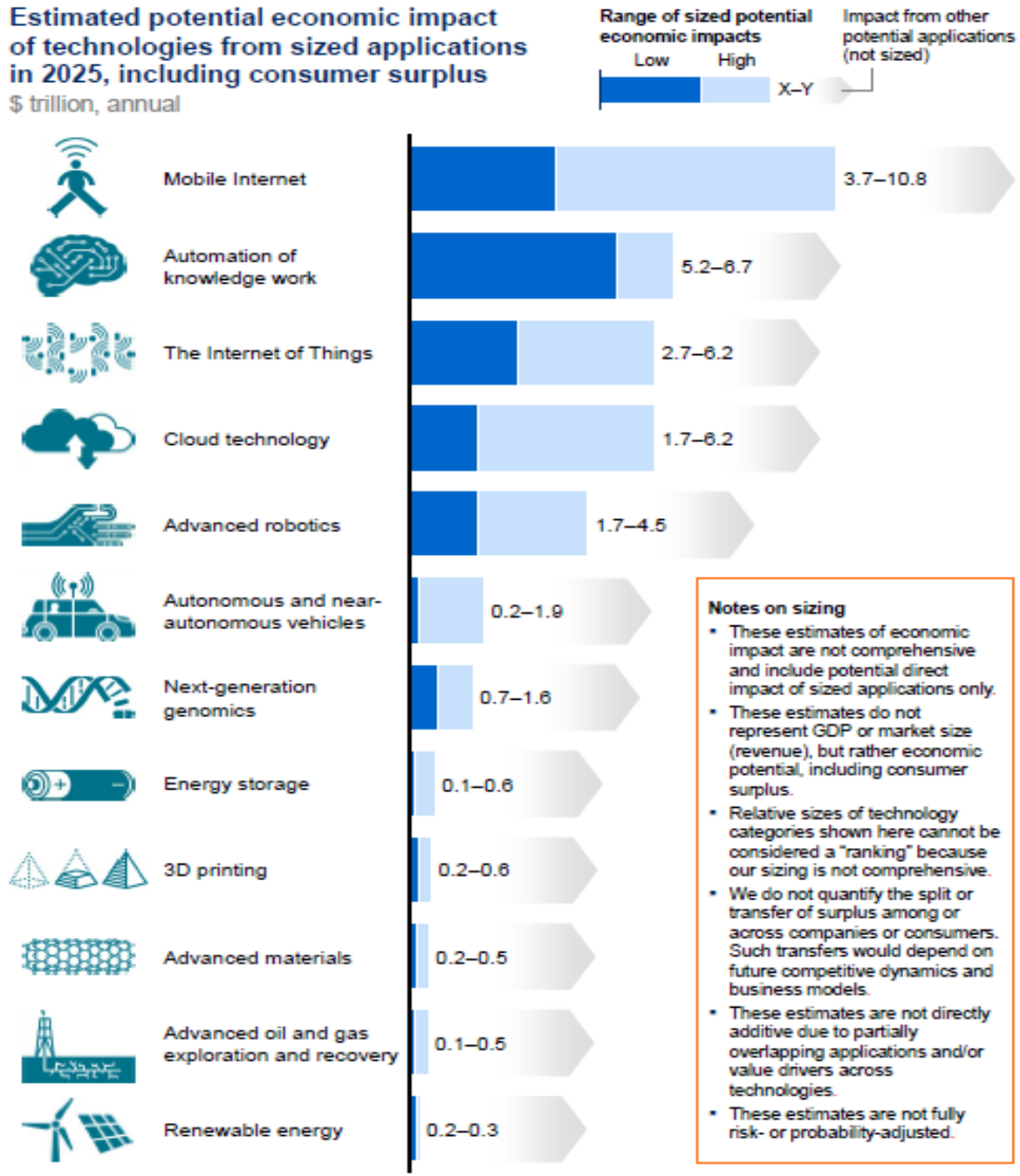
Exploration and recovery techniques that make extraction of unconventional oil and gas economical

Renewable energy

Generation of electricity from renewable sources with reduced harmful climate impact

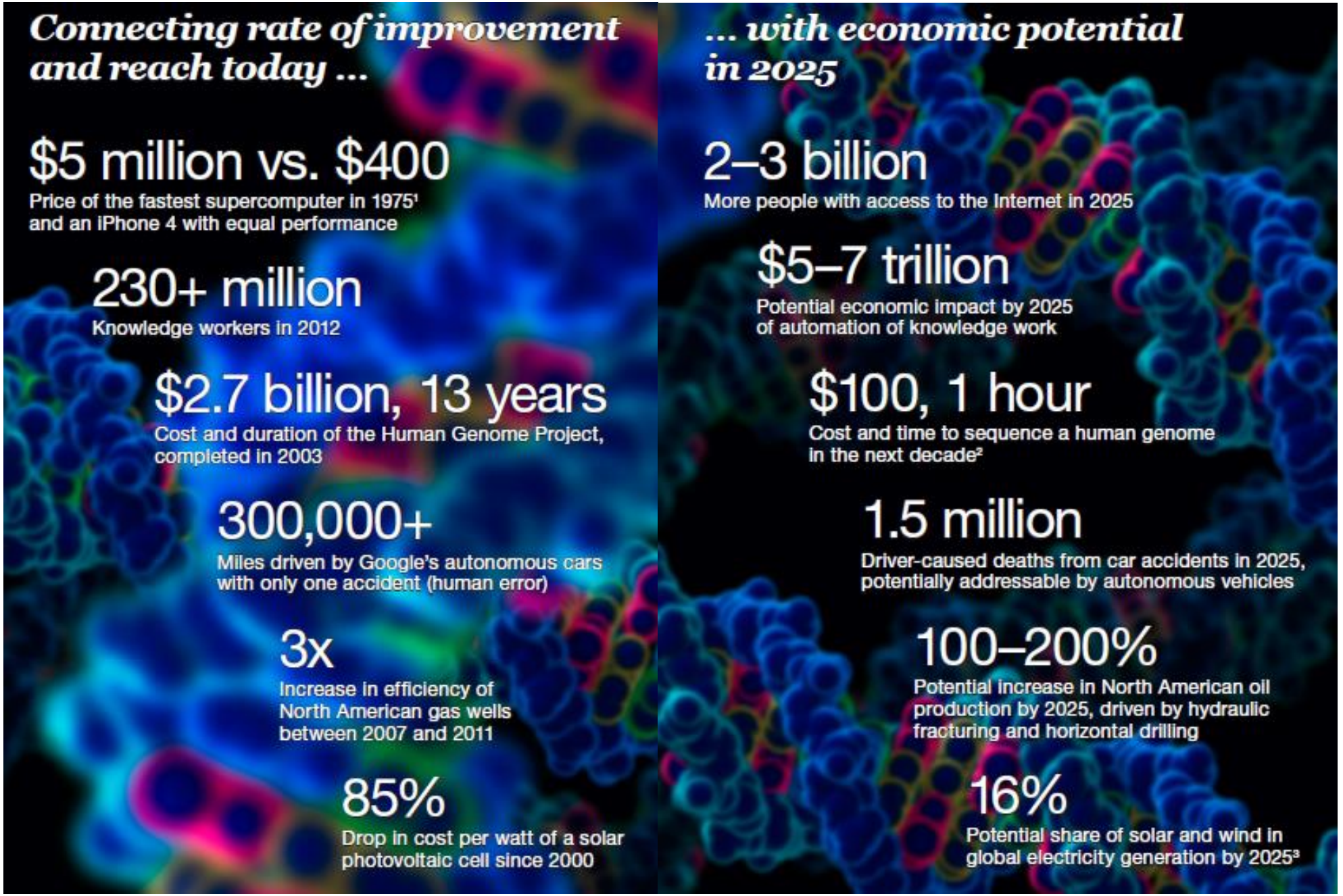
SOURCE: McKinsey Global Institute analysis

Disruptive technologies: Advances that will transform life, business, and the global economy



Speed, scope, and economic value at stake of 12 potentially economically disruptive technologies

	Illustrative rates of technology improvement and diffusion	Illustrative groups, products, and resources that could be impacted[1]	Illustrative pools of economic value that could be impacted[1]
Mobile Internet	**$5 million vs. $400[2]** Price of the fastest supercomputer in 1975 vs. that of an iPhone 4 today, equal in performance (MFLOPS) **6x** Growth in sales of smartphones and tablets since launch of iPhone in 2007	**4.3 billion** People remaining to be connected to the Internet, potentially through mobile Internet **1 billion** Transaction and interaction workers, nearly 40% of global workforce	**$1.7 trillion** GDP related to the Internet **$25 trillion** Interaction and transaction worker employment costs, 70% of global employment costs
Automation of knowledge work	**100x** Increase in computing power from IBM's Deep Blue (chess champion in 1997) to Watson (Jeopardy winner in 2011) **400+ million** Increase in number of users of intelligent digital assistants like Siri and Google Now in past 5 years	**230+ million** Knowledge workers, 9% of global workforce **1.1 billion** Smartphone users, with potential to use automated digital assistance apps	**$9+ trillion** Knowledge worker employment costs, 27% of global employment costs
The Internet of Things	**300%** Increase in connected machine-to-machine devices over past 5 years **80–90%** Price decline in MEMS (microelectromechanical systems) sensors in past 5 years	**1 trillion** Things that could be connected to the Internet across industries such as manufacturing, health care, and mining **100 million** Global machine to machine (M2M) device connections across sectors like transportation, security, health care, and utilities	**$36 trillion** Operating costs of key affected industries (manufacturing, health care, and mining)
Cloud technology	**18 months** Time to double server performance per dollar **3x** Monthly cost of owning a server vs. renting in the cloud	**2 billion** Global users of cloud-based email services like Gmail, Yahoo, and Hotmail **80%** North American institutions hosting or planning to host critical applications on the cloud	**$1.7 trillion** GDP related to the Internet **$3 trillion** Enterprise IT spend
Advanced robotics	**75–85%** Lower price for Baxter[3] than a typical industrial robot **170%** Growth in sales of industrial robots, 2009–11	**320 million** Manufacturing workers, 12% of global workforce **250 million** Annual major surgeries	**$8 trillion** Manufacturing worker employment costs, 19% of global employment costs **$2–3 trillion** Cost of major surgeries
Autonomous and near-autonomous vehicles	**7** Miles driven by top-performing driverless car in 2004 DARPA Grand Challenge along a 150-mile route **1,540** Miles cumulatively driven by cars competing in 2005 Grand Challenge **300,000+** Miles driven by Google's autonomous cars with only 1 accident (which was human-caused)	**1 billion** Cars and trucks globally **450,000** Civilian, military, and general aviation aircraft in the world	**$4 trillion** Automobile industry revenue **$155 billion** Revenue from sales of civilian, military, and general aviation aircraft
Next-generation genomics	**10 months** Time to double sequencing speed per dollar **100x** Increase in acreage of genetically modified crops, 1996–2012	**26 million** Annual deaths from cancer, cardiovascular disease, or type 2 diabetes **2.5 billion** People employed in agriculture	**$6.5 trillion** Global health-care costs **$1.1 trillion** Global value of wheat, rice, maize, soy, and barley
Energy storage	**40%** Price decline for a lithium-ion battery pack in an electric vehicle since 2009	**1 billion** Cars and trucks globally **1.2 billion** People without access to electricity	**$2.5 trillion** Revenue from global consumption of gasoline and diesel **$100 billion** Estimated value of electricity for households currently without access
3D printing	**90%** Lower price for a home 3D printer vs. 4 years ago **4x** Increase in additive manufacturing revenue in past 10 years	**320 million** Manufacturing workers, 12% of global workforce **8 billion** Annual number of toys manufactured globally	**$11 trillion** Global manufacturing GDP **$85 billion** Revenue from global toy sales
Advanced materials	**$1,000 vs. $50** Difference in price of 1 gram of nanotubes over 10 years **115x** Strength-to-weight ratio of carbon nanotubes vs. steel	**7.6 million tons** Annual global silicon consumption **45,000 metric tons** Annual global carbon fiber consumption	**$1.2 trillion** Revenue from global semiconductor sales **$4 billion** Revenue from global carbon fiber sales
Advanced oil and gas exploration and recovery	**3x** Increase in efficiency of US gas wells, 2007–11 **2x** Increase in efficiency of US oil wells, 2007–11	**22 billion** Barrels of oil equivalent in natural gas produced globally **30 billion** Barrels of crude oil produced globally	**$800 billion** Revenue from global sales of natural gas **$3.4 trillion** Revenue from global sales of crude oil
Renewable energy	**85%** Lower price for a solar photovoltaic cell per watt since 2000 **19x** Growth in solar photovoltaic and wind generation capacity since 2000	**21,000 TWh** Annual global electricity consumption **13 billion tons** Annual CO_2 emissions from electricity generation, more than from all cars, trucks, and planes	**$3.5 trillion** Value of global electricity consumption **$80 billion** Value of global carbon market transactions


Connecting rate of improvement and reach today ...
$5 million vs. $400
Price of the fastest supercomputer in 1975[1] and an iPhone 4 with equal performance
230+ million
Knowledge workers in 2012
$2.7 billion, 13 years
Cost and duration of the Human Genome Project, completed in 2003
300,000+
Miles driven by Google's autonomous cars with only one accident (human error)
3x
Increase in efficiency of North American gas wells between 2007 and 2011
85%
Drop in cost per watt of a solar photovoltaic cell since 2000
... with economic potential in 2025
2–3 billion
More people with access to the Internet in 2025
$5–7 trillion
Potential economic impact by 2025 of automation of knowledge work
$100, 1 hour
Cost and time to sequence a human genome in the next decade[2]
1.5 million
Driver-caused deaths from car accidents in 2025, potentially addressable by autonomous vehicles
100–200%
Potential increase in North American oil production by 2025, driven by hydraulic fracturing and horizontal drilling
16%
Potential share of solar and wind in global electricity generation by 2025[3]