TRACKING THE ENERGY REVOLUTION

GLOBAL EDITION 2014

CLEAN ENERGY CANADA

IT'S ON

WHY CANADA SHOULD PAY CLOSE ATTENTION TO THE GLOBAL CLEAN ENERGY TRANSITION

Something big is underway out there.

Buoyed by enabling public policy and a rising flood of investment, companies, countries, and whole economies are steadily reducing their dependence on fossil fuels and embracing clean and renewable energy.

Though carbon-based fuels will remain an important part of our energy system for decades to come, for the first time in more than a century, multiple signs suggest that their dominance is beginning to wane.

Don't just take our word for it. In the past year, management-consulting firm McKinsey & Company said that better and cleaner technologies are underpinning "a new industrial revolution." Deutsche Bank dramatically lifted its solar-industry demand forecast—predicting that a staggering 46 gigawatts of global solar power will come online this year. China is installing a new wind turbine every hour. And Royal Dutch Shell, the largest oil company in the world by revenue, listed a litany of reasons why business should love a price on carbon pollution.

We're hearing similar language from the likes of President Obama and his cabinet. We're hearing it from China, the world's largest clean-energy investor. And we're hearing it from some of the world's most popular brands.

This shift won't happen overnight. Some big players, like Australia, will slide backwards before moving forward again. But the overall trend is inexorable progress, driven by innovation, an increasing desire for energy independence, and a growing awareness of climate disruption.

This document flags a number of key investment, policy, and technology markers that define this clean-energy shift. It pulls together threads from a wide variety of sources to demonstrate that the clean-energy transition is no longer the domain of dreamers and early adopters. Instead, it's quickly becoming the new "business as usual."

We pulled this report together because we believe Canada's leaders need to take this shift to heart and take steps to minimize the risks it presents for the country, while maximizing its opportunities. We hope you find it useful, and welcome your feedback.

Merran Smith
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Cover: Technicians at Northland Power's 100 MW Mont Louis wind farm in Québec's Gaspésie region, summer 2011. Photo by Joan Sullivan.
This page: The Mueller neighbourhood is a pilot smart-grid community in the Pecan Street Research Project, in Austin, Texas.
Report Design: Patrick Connelly

MAPPING THE GLOBAL CLEAN ENERGY TRANSITION

A Snapshot of Renewable Energy Goals and Investments

Last year, investors poured $207 billion into clean energy deployment around the world. They're following the opportunities unlocked by governments that seek to meaningfully address climate disruption, retain competitiveness, and create opportunities. Here, a tour of clean-energy investment hot spots.

TOP FIVE COUNTRIES FOR RENEWABLE ENERGY INVESTMENT IN 2013 (BILLIONS)*

1.	CHINA [1]	$55
2.	UNITED STATES [2]	$36
3.	JAPAN [4]	$30
4.	UK [6]	$12
5.	GERMANY [3]	$11

**Number in parentheses denotes country's rank in 2012. All dollar figures in this document are $USD unless otherwise noted.*

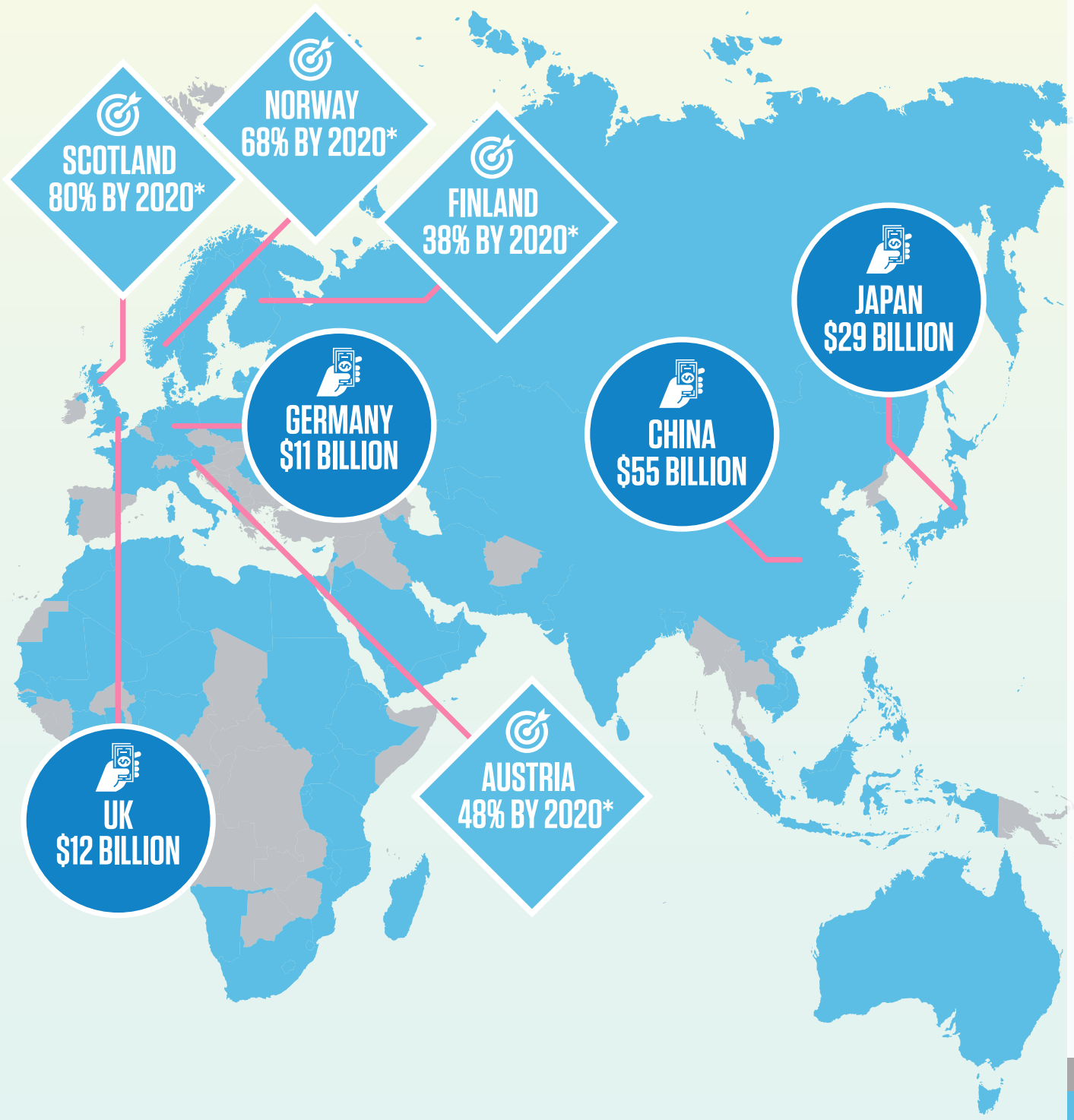
GLOBAL CLEAN-ENERGY INVESTMENT, 2013:

$207 BILLION

GLOBAL FOSSIL-FUEL POWER GENERATION INVESTMENT, 2013: $270 BILLION

CANADA SPOTLIGHT

IN CANADA, 2013 SAW AN INVESTMENT OF $6.53 BILLION INTO CLEAN ENERGY - RANKING US SEVENTH AMONG G20 COUNTRIES.



FUTURE TARGETS

As of the end of last year, 144 countries had targets for renewable energy. Here's who joined the leadership circle in 2013, and who stepped up their game.

NEW 2013 CLEAN ENERGY TARGETS:

AZERBAIJAN, BHUTAN, KAZAKHSTAN, KENYA, QATAR, RUSSIA

STRENGTHENED 2013 TARGETS:

CARIBBEAN COMMUNITY, CHILE, CHINA, EGYPT, INDIA, LIBYA, PORTUGAL, SAUDI ARABIA, THAILAND, UNITED KINGDOM, URUGUAY, VANUATU

TOP 2020 POLICY TARGETS*

1.	URUGUAY	100%
2.	SCOTLAND	80%
3.	NORWAY	68%
4.	AUSTRIA	45%
5.	FINLAND	38%

* *Targets represent the percentage of primary or final energy to be sourced from clean and renewable sources by 2020.*

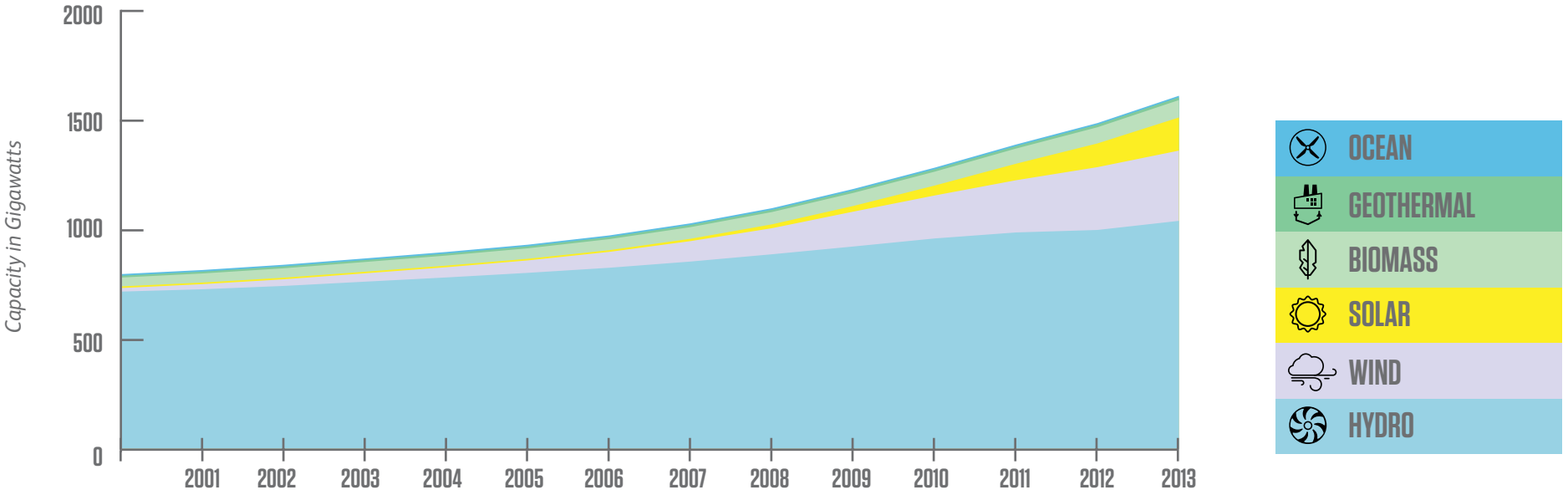
MAP LEGEND

Countries highlighted denote those with national clean and renewable energy targets.

Source: Bloomberg New Energy Finance, International Renewable Energy Agency, Pew Research, Renewable Energy Policy Network for the 21st Century. Total new investment calculations include biofuels, geothermal, marine, small hydro, solar, and wind, but exclude large hydro.

HOW MUCH IS RENEWABLE ENERGY GROWING?

Answer: A lot. While hydro holds steady, in recent years wind and solar have climbed the charts and are now stepping up their role in the global clean-energy mix.



2013 RENEWABLE CAPACITY (GIGAWATTS)

HYDRO 1000	BIO-ENERGY 77
WIND 309	GEOTHERMAL 12
SOLAR 146	OCEAN 0.5

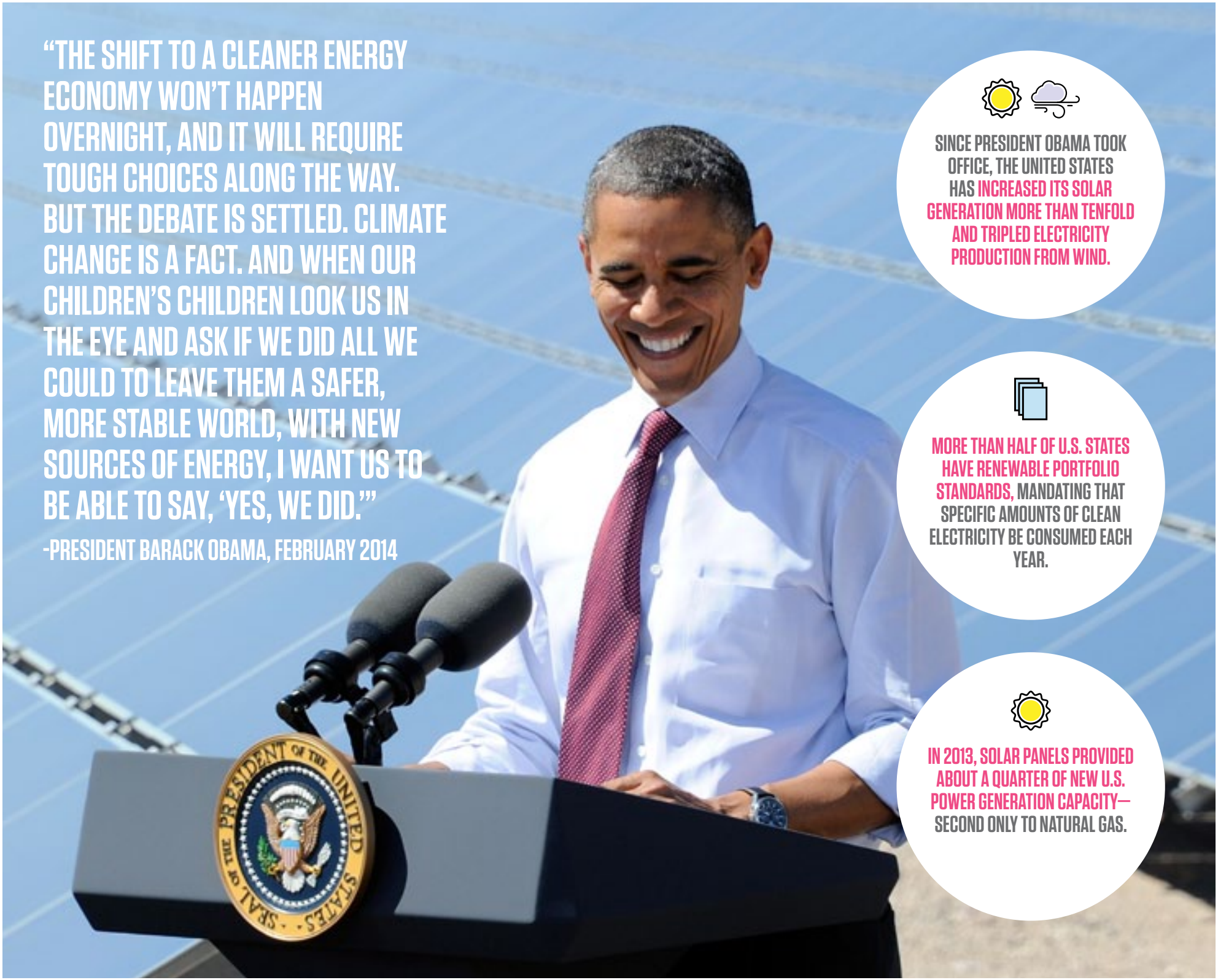
IN 2013 WIND ENERGY GENERATED
ENOUGH POWER WORLDWIDE TO SURPASS CANADA'S TOTAL ELECTRICITY CONSUMPTION IN 2012.

3.1 MILLION AUSTRALIANS
LIVED OR WORKED AT A PROPERTY WITH SOLAR PANELS AT THE END OF 2013

CANADA SPOTLIGHT

SINCE 2000, NEW WIND TURBINES HAVE CONTRIBUTED TO MORE THAN HALF OF THE TOTAL INCREASE IN RENEWABLE ENERGY CAPACITY IN CANADA—MOST OF THEM IN QUEBEC AND ONTARIO.

Sources: Alberta Electric System Operator, Bloomberg New Energy Finance, Clean Energy Council, Renewable Energy Policy Network for the 21st Century, U.S. Department of Energy, U.S. Energy Information Administration, World Wind Energy Association.


"THE SHIFT TO A CLEANER ENERGY ECONOMY WON'T HAPPEN OVERNIGHT, AND IT WILL REQUIRE TOUGH CHOICES ALONG THE WAY. BUT THE DEBATE IS SETTLED. CLIMATE CHANGE IS A FACT. AND WHEN OUR CHILDREN'S CHILDREN LOOK US IN THE EYE AND ASK IF WE DID ALL WE COULD TO LEAVE THEM A SAFER, MORE STABLE WORLD, WITH NEW SOURCES OF ENERGY, I WANT US TO BE ABLE TO SAY, 'YES, WE DID.'"
-PRESIDENT BARACK OBAMA, FEBRUARY 2014
SINCE PRESIDENT OBAMA TOOK OFFICE, THE UNITED STATES HAS INCREASED ITS SOLAR GENERATION MORE THAN TENFOLD AND TRIPLED ELECTRICITY PRODUCTION FROM WIND.
MORE THAN HALF OF U.S. STATES HAVE RENEWABLE PORTFOLIO STANDARDS, MANDATING THAT SPECIFIC AMOUNTS OF CLEAN ELECTRICITY BE CONSUMED EACH YEAR.
IN 2013, SOLAR PANELS PROVIDED ABOUT A QUARTER OF NEW U.S. POWER GENERATION CAPACITY—SECOND ONLY TO NATURAL GAS.

THE NEW "BUSINESS AS USUAL"

Fortune 500 Firms and Investors of All Stripes Are Getting In On the Action

The International Energy Agency has called for the mobilization of $36 trillion in clean energy investments by 2050 to avoid the threat of serious climate disruption. It's just 35 percent more than what the world will invest anyway in energy infrastructure by 2050, and a recent analysis suggests that the public-health costs saved from reduced fossil fuel combustion would more than make up for the difference. We're not even close to that, but here are three promising pathways:

CANADA SPOTLIGHT

IN 2013, THREE GREEN BOND ISSUANCES FOR ONTARIO AND QUEBEC WIND AND SOLAR FARMS TOTALLED CAD$855 MILLION.

CROWDFINANCING: OPPORTUNITIES FOR EVERYONE

A number of companies are following in the footsteps of Mosaic *(joinmosaic.com)*, which since 2011 has mobilized $8.5 million in individual investments for solar projects. In the U.K., Trillion Fund *(trillionfund.com)* and Abundance Generation *(abundancegeneration.com)*—are underwriting wind and solar farms via individual investors who make modest investments and see returns in the range of four to seven percent. SolarCity, a leading U.S. provider of solar energy systems to homes and businesses, plans to offer individual investments over the internet later this year. The concept is coming soon to Canada with the upcoming launch of CoPower *(copower.me)*.

"THIS IS 'CROWD' WITH A CAPITAL 'C'. CROWD ISN'T A NICHE THING. IT'S EVERYTHING BUT THAT TOP HANDFUL OF INSTITUTIONS."

–TIM NEWELL, VICE-PRESIDENT, SOLARCITY

GREEN BONDS FUNDING CLEAN ENERGY

The global bond market is an $80 trillion concern, and the Climate Bonds Initiative *(climatebonds.net)* seeks to mobilize it to advance clean energy and low-carbon solutions. Last year, the organization tracked $41 billion in bonds targeting clean energy investment and attributed a further $263 billion to low-carbon transportation investments.

Bonds are particularly suited to providing capital for the long-term infrastructure required to build a low-carbon, climate-resilient economy. The extra upfront investments are often balanced by much lower operating costs, making the instruments a good fit. From 2012 to 2013, the universe of climate-themed bonds grew from $174 to $346 billion.

MONEY ON THE MOVE: DIVESTMENT AND THE FOSSIL FREE INDEX

A growing chorus of leaders are calling on foundations, universities, pension funds, churches, and other institutions to divest from fossil fuel companies—and the markets are responding with options.

This past spring, FTSE Group, the global index provider, launched the FTSE Developed ex Fossil Fuels Index Series. Created with the Natural Resources Defense Council and BlackRock, the world's largest asset manager, the series consists of a set of benchmark indices that exclude companies that explore, own or extract carbon-based fossil fuel reserves. It is an example of post-carbon investing moving squarely into the mainstream.

BIG BRANDS STEP UP

Sixty percent of Fortune 100 firms now have goals for renewable energy sourcing and/or greenhouse gas reductions. Fifty-three of those companies have collectively decreased their annual CO_2 emissions by about 58 million metric tonnes—the equivalent of taking 15 million vehicles off the roads. Power-thirsty internet firms are also leading the way. Here are a few standouts.

Google

The search giant has invested more than **$1 billion** to date in 15 renewable energy projects, and now powers **34 percent** of its data centres with renewable energy.

Walmart

To save $1 billion per year, the big-box goliath aims to be powered by **100 percent** renewable energy **by 2020**. The company already has 335 clean energy projects up and running, supplying almost 25 percent of its energy needs.

In 2013 Apple said it would work to power **100 percent** of its facilities with renewable energy. Its iCloud service has already reached that target and it is actively targeting areas rich in clean energy resources to site infrastructure.

IKEA

Within three years, IKEA expects to meet 70 percent of its electricity demand from its own renewable energy plants—and **100 percent by 2020**.

Starbucks is on track for its goal of purchasing renewable energy equivalent to **100 percent** of the electricity used in its stores **by 2015**.

facebook

In 2011, everyone's favourite social network pledged to move toward **100 percent** renewable energy. The company located a new data centre in Iowa, where a utility invested nearly **$2 billion** in wind turbines to close the deal.

Sources: Ceres, Calvert Investments, Coronet, Greenpeace International, Sustainable Prosperity, World Wildlife Fund and David Gardiner & Associates.

POLITICAL LEADERSHIP MAKING A BETTER FUTURE

How and Where Good Policy is Reducing Pollution and Spurring Renewables

More than 25 jurisdictions around the world now internalize the costs of carbon pollution—collectively representing approximately $33 trillion worth of global GDP and more than one billion people. Meanwhile, close to 80 economies have instituted policies to phase out fossil-fuel power plants and replace them with clean alternatives.

CANADA SPOTLIGHT

B.C.'S CARBON TAX HAS LOWERED FUEL CONSUMPTION 16 PERCENT. MEANWHILE, THE ECONOMY HAS OUTPERFORMED THE REST OF CANADA.

CARBON PRICING

Carbon Taxes and Emissions Trading Around the World*

It is no longer a question of whether or not economies will internalize the costs of carbon pollution; it's a question of when. A growing number of national and subnational governments—including those shown here—are now using a carbon tax, cap-and-trade program, or similar market-based mechanism to level the playing field between clean and fossil energy. The energy shift will proceed with or without a carbon price, but such policies will help accelerate clean innovation—and truly unleash the power of the market against climate disruption.

CANADA (THREE PROVINCES)
2006, 2007, 2008

CHINA (SIX PROVINCES)
2013

EUROPEAN UNION
2005

ICELAND
2007

JAPAN
2012

KAZAKHSTAN
2013

MEXICO
2014

NEW ZEALAND
2008

NORWAY
1991

UNITED STATES (NINE STATES)
2008, 2012

** Carbon taxes and emissions trading schemes around the world, with the year the policy was implemented.*

THE WINNERS' CIRCLE

As of last year, 131 jurisdictions had implemented renewable portfolio standards, feed in tariffs, or other policies and regulations to mandate or incent wind, solar, hydro and other clean energy sources.

ALBANIA, ALGERIA, ARGENTINA, ARIZONA, ARMENIA, AUSTRALIA [SEVEN STATES & TERRITORIES], AUSTRIA, BOSNIA AND HERZEGOVINA, BRITISH COLUMBIA, BELGIUM [THREE REGIONS], BULGARIA, CALIFORNIA, CHINA, COLORADO, CONNECTICUT, CROATIA, CYPRUS, DELAWARE, DENMARK, DISTRICT OF COLUMBIA, DOMINICAN REPUBLIC, ECUADOR, ESTONIA, FINLAND, FRANCE, GERMANY, GHANA, GREECE, HAWAII, HONDURAS, HUNGARY, ILLINOIS, INDIA, INDONESIA, IOWA, IRAN, IRELAND, ISRAEL, ITALY, JAPAN, JORDAN, KANSAS, KAZAKHSTAN, KENYA, KYRGYZSTAN, LATVIA, LITHUANIA, LUXEMBOURG, MACEDONIA, MAINE, MALAYSIA, MALDIVES, MALTA, MARYLAND, MASSACHUSETTS, MICHIGAN, MINNESOTA, MISSOURI, MOLDOVA, MONGOLIA, MONTANA, NETHERLANDS, NEVADA, NEW BRUNSWICK, NEW HAMPSHIRE, NEW JERSEY, NEW MEXICO, NEW YORK, NEWFOUNDLAND, NICARAGUA, NIGERIA, NORTH CAROLINA, NORWAY, NOVA SCOTIA, OHIO, ONTARIO, OREGON, PAKISTAN, PALAU, PALESTINE, PANAMA, PENNSYLVANIA, PERU, PHILIPPINES, POLAND, PORTUGAL, PRINCE EDWARD ISLAND, QUEBEC, RHODE ISLAND, ROMANIA, RWANDA, SENEGAL, SERBIA, SLOVAKIA, SLOVENIA, SOUTH AFRICA, SOUTH KOREA, SRI LANKA, SWEDEN, SWITZERLAND, SYRIA, TAJIKISTAN, TANZANIA, TEXAS, THAILAND, TURKEY, UGANDA, UKRAINE, UNITED ARAB EMIRATES, UNITED KINGDOM, URUGUAY, VERMONT, VIETNAM, WASHINGTON, WISCONSIN, YUKON

IRON IN THE GROUND

Developing nations are now rubbing elbows with long-established wind and solar players, building new clean-generation facilities at a breakneck pace.

PEOPLE EMPLOYED IN RENEWABLE ENERGY WORLDWIDE:

6.5 MILLION

TOP FIVE NATIONS FOR ADDED CLEAN ENERGY IN 2013*

1. CHINA [1]	31 GW
2. JAPAN [4]	7.2 GW
3. UNITED STATES [2]	7 GW
4. GERMANY [3]	6.7 GW
5. INDIA [6]	3.4 GW

**Calculation represents new capacity added in 2013. Number in parentheses denotes country's rank in 2012.*

LARGEST NEW CLEAN POWER PLANTS IN 2013

WIND ENERGY

1.55 GW

Alta Wind Energy Center, Tepachi Pass, California

= **450,000** HOMES POWERED BY RENEWABLE ENERGY

CONCENTRATED SOLAR

0.38 GW

Ivanpah, Dry Lake, California

= **140,000** HOMES POWERED BY RENEWABLE ENERGY

Sources: Bloomberg New Energy Finance, Bright Source, Database of State Incentives for Renewables & Efficiency, Energy Matters, Renewable Energy Policy for the 21st Century, Renewable Energy Policy Legal, Terra-Gen Power, U.S. Energy Information Administration, World Bank.

DISPATCHES FROM THE WAR ON POLLUTION

China is Rapidly Reinventing its Energy System

China isn't overhauling its energy system to impress the West. It's doing so in an effort to head off a pollution revolution.

As Ethan Zindler of Bloomberg New Energy Finance recently put it, "When folks can't leave the house on a sunny day because the air quality is so poor, then you have a civil rights issue in your country."

While we have long been hearing that China has been installing a new coal plant each week, last year that changed dramatically when coal's share of new generation capacity dropped to 42 percent. For the first time, China invested more money in new clean-energy capacity than it did in fossil-fuel based thermal generation; wind, solar, geothermal, and marine energy generated 56 percent of new electrons.

The country invested $56.3 billion in clean energy technologies, the world's largest investor by a wide margin.

The big news is solar. China began putting in policies to boost demand for solar modules—the heart of a solar panel. This has led to staggering investments. No country has ever installed more than eight gigawatts of solar photovoltaics in a single year, Zindler reports. But last year, ***China installed nine gigawatts in a single quarter.***

Then there's wind. Even with a late start in 2007, China is already the world leader in wind power with 89 GW of capacity. ***A new wind turbine goes up every hour.*** It plans to reach 200 GW of wind capacity by decade's end. Compare that with European member states, who collectively have 115 GW of wind.

Beijing has launched pilot carbon markets in seven cities and provinces to prepare for the rollout of a national market later in the decade, expected sometime between 2017 and 2020.

DOMESTIC AVIATION ON THE CHOPPING BLOCK

In the past decade, China has built 9,867 km of electrified high speed rail—the system is now the largest and most popular of its kind in the world. The investment is reducing the transportation sector's dependence on imported petroleum. Domestic airlines are reporting a greater than 20 percent drop in profits.

60% OF CHINESE INFRASTRUCTURE INVESTMENT IS IN HIGH SPEED RAIL.

22,726 KM

China's built, under construction, and planned high speed rail network. That's roughly three times more than Europe's current installed infrastructure.

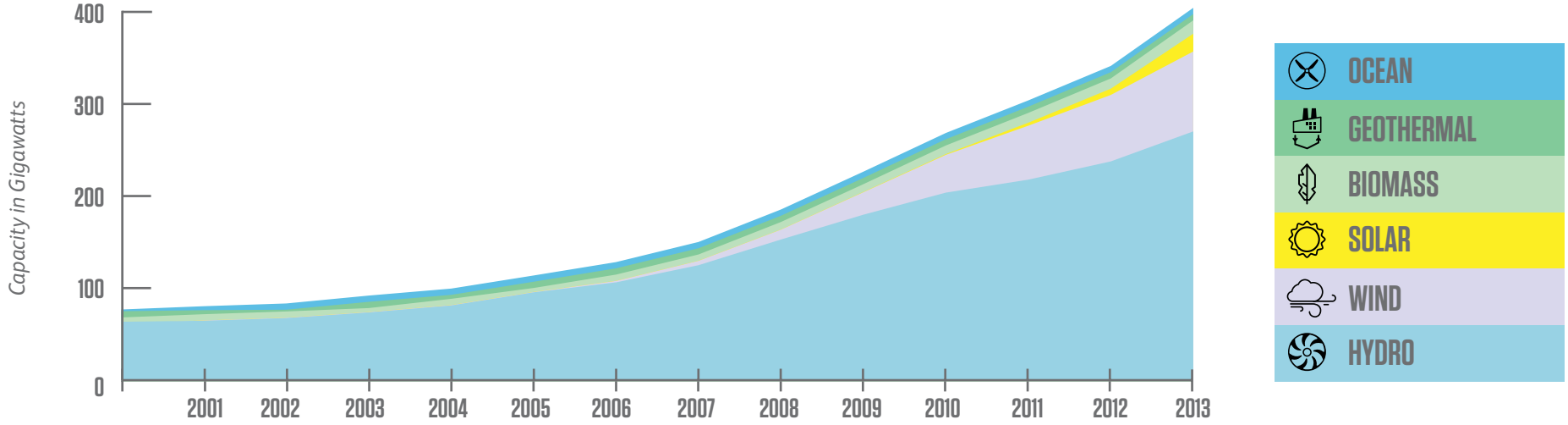
CANADA SPOTLIGHT

BETWEEN 2001 AND 2011, CHINA INCREASED ITS IMPORTS OF CANADIAN CLEANTECH GOODS AND SERVICES FROM $20 MILLION TO $63 MILLION.

Sources: Bloomberg New Energy Finance, China Daily, Global Wind Energy Council, International Hydropower Association, International Union of Railways, Reuters, Statistics Canada, World Bank, Worldwatch Institute.

GREENING THE DRAGON

The world's biggest polluter is leaving its renewable-energy rivals in the dust.



"WE WILL DECLARE WAR AGAINST POLLUTION AND FIGHT IT WITH THE SAME DETERMINATION WE BATTLED POVERTY. WE WILL CHANGE THE WAY ENERGY IS PRODUCED AND CONSUMED."

–Li Keqiang, Premier of the State Council of China, Twelfth National People's Congress, March 2014

NUMBER ONE IN WIND

China has its sights set on 138 GW of wind by 2020. It has installed more wind capacity since 2007 than Germany or the United States has in 30 years.

16% ENERGY INTENSITY REDUCTION BY 2015

This is an effort to decouple economic growth from energy consumption in the world's second-largest economy.

NUMBER ONE IN SOLAR

China installed 12 GW of solar in 2013. That's more than any other country has in a single year. For the first time, new renewable-power capacity surpassed new thermal (coal) capacity.

$300 BILLION INVESTED*

In 2004, China invested $2 billion in renewable energy. Last year, the number was $56 billion.

** Investment calculations from BNEF, excluding large hydro.*

ELECTRIC VEHICLES CHARGE AHEAD

Battery-Powered Mobility Merges into the Mainstream

Plug-in electric vehicles are an increasingly attractive option for individuals and companies interested in reducing their fuel costs and pollution. A range of vehicles are now widely available, and governments are implementing policy support to get them into broader circulation. Navigant Research, a leading firm, expects more than 35 million EVs will be on roads worldwide by 2022.

CANADA SPOTLIGHT

HYDRO QUEBEC'S ELECTRIC CIRCUIT PUBLIC EV CHARGING NETWORK INVITES DRIVERS TO "FILL UP" WITH RENEWABLE ENERGY AT MORE THAN 280 LOCATIONS PROVINCE-WIDE.

FIVE EV FACTS YOU SHOULD KNOW

1. THEY'RE INCREASINGLY AFFORDABLE

When one factors in fuel costs, electric vehicles are cost-competitive with many gasoline-engine vehicles. A recent analysis found that fleet operators could save an average of $16,000 over seven years by switching to EVs. Even without incentives, the average savings would pencil out to more than $10,000.

2. BATTERIES ARE GETTING CHEAPER

The costs of lithium-ion cells have dropped roughly eight percent for each of the past 20 years. In other words, **every eight years, battery prices drop by half**. Plus, Tesla is building a factory—to open in 2020—that will produce on one site as many lithium-ion batteries as the entire world does today. Expect a solar-panel-style price plunge to follow.

3. THERE ARE PLENTY OF PLACES TO PLUG IN

Governments know that range anxiety remains a lead barrier to EV adoption, and are responding by investing in public charging stations. According to a recent report, worldwide sales of chargers are expected to grow in numbers from around 442,000 units in 2013, to a massive 4.3 million in 2022.

4. RECHARGING IS A SNAP

While gas cars can be refuelled faster than EVs can be recharged, electrics can be topped up overnight, and during the day while their owners work, learn, or shop. Tesla's super-fast chargers only work with Tesla vehicles, so far, but since the company released its patents, Nissan and BMW have entered into discussions to adopt the technology.

5. THEY'LL GET ME WHERE I NEED TO GO

The data shows that 95 percent of motorists drive no farther than 58 km in cities and 77 km in rural areas. EVs will take you between 100 and 426 km on a single charge. ***Drivers just need to remember to treat their car like their phone—and plug it in at bedtime.***

Sources: Hydro Quebec, IHS Research, Navigant Research, Plug in B.C., Plug'n Drive, Solar Journey USA

MAKE IT SO

TESLA MOTORS CEO ELON MUSK IS OUR GLOBAL INNOVATOR OF THE YEAR

He's a blend of Steve Jobs design perfectionism and Henry Ford business savvy, with a dash of Gene Roddenberry prescience. Tesla Motors CEO Elon Musk, who is also the chair of SolarCity—the largest firm in the business of bolting panels on U.S. homes and businesses—is perhaps the most influential and disruptive business figure on the global clean energy scene. His company's all-electric Model S sedan earned the highest score *Consumer Reports* ever awarded, a five-star crash-test rating, and a Car of the Year trophy from *Motor Trend*. And like a 21st century Henry Ford, he's embracing vertical supply-chain integration, building a colossal Gigafactory that will supply his assembly plants with lithium-ion batteries. Meanwhile, under his direction, SolarCity will build the largest solar panel assembly plant in the United States. Oh, did we mention he builds rockets, too?

Elon Musk, CEO Tesla Motors

THE GREAT GRID SHAKEUP

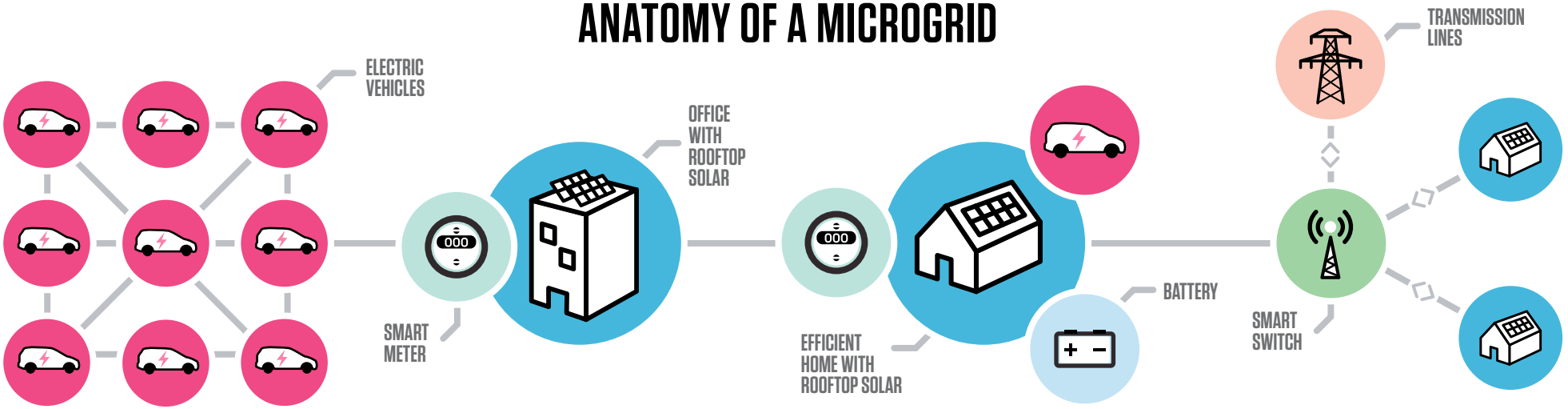
Microgrids Invite Neighbourhoods to Grab Control of Their Electrons

When used in combination, rooftop solar panels, power storage packs, electric vehicles, smart meters, and related equipment can make cities and neighbourhoods more resilient and efficient. In the United States and elsewhere, universities and communities are knitting these local power generation and storage assets together to create microgrids—semi-autonomous neighbourhood electricity nodes.

Microgrids allow businesses, homes, and schools in a given district to share power and resources as needed to help reduce peak loads—such as a surge in air conditioning during a heat wave—or keep the lights on for essential services during a blackout caused by severe weather, such as an ice storm. Though there are few microgrids in Canada, in the United States, microgrid capacity stands at 1,051 megawatts and is expected to reach approximately 1,843 megawatts by the end of 2017.

Though legal and social barriers are keeping the microgrid as more of a concept than a reality in Canada, all the technologies exist to deliver on its promise. Here's how they would work.

ANATOMY OF A MICROGRID



NEIGHBOURHOOD EV FLEET

A neighbourhood car-sharing lot would serve as a giant collective battery, ready to supply the microgrid when needed to offset peak loads and reduce the need for redundant transmission cables. This in turn reduces system costs and keeps rates down for customers.

DOMESTIC POWER PLANT

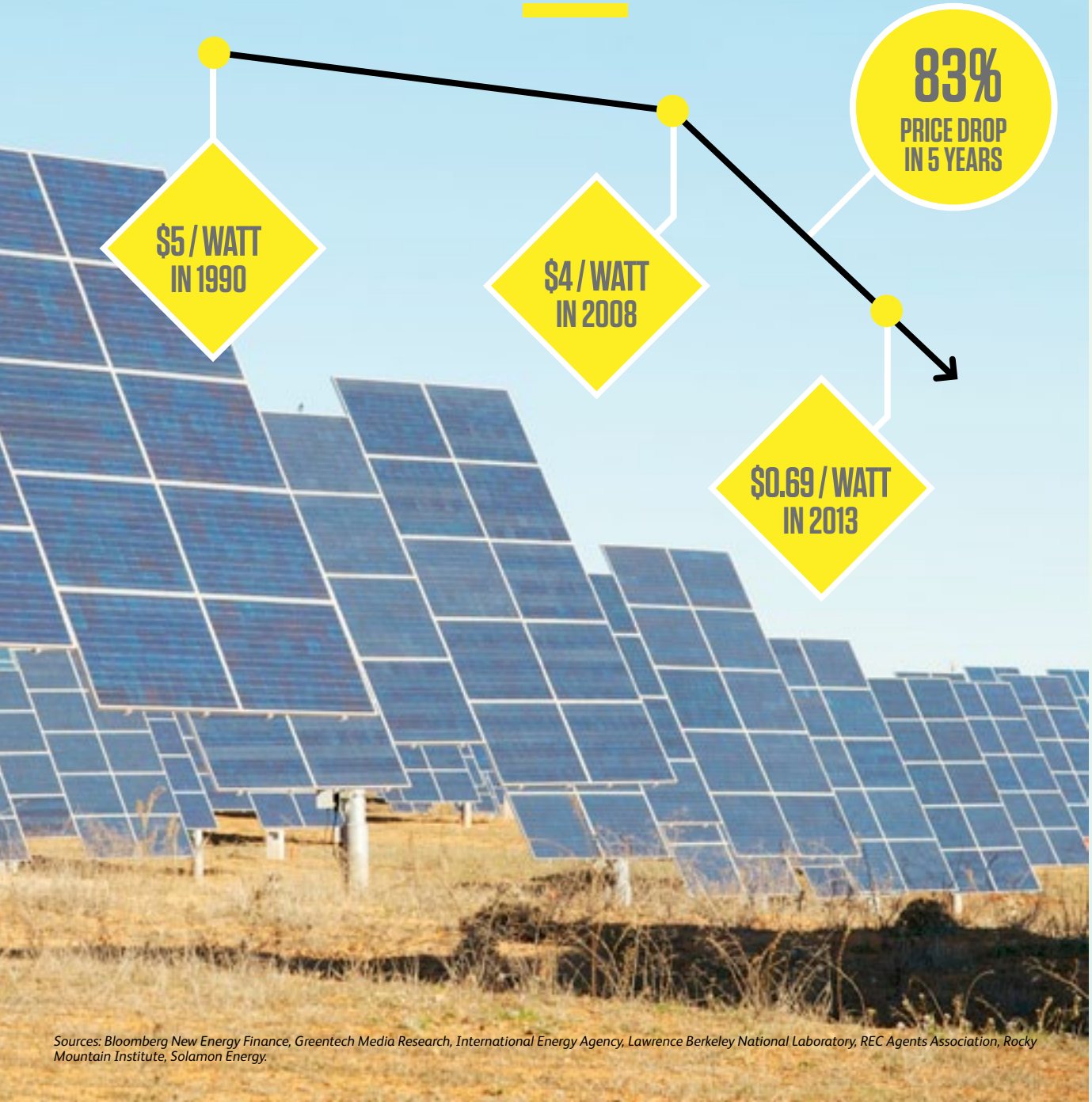
When power needs are low—for example during the day when nobody is home—rooftop solar panels could top up in-home battery packs, such as those made by Tesla Motors. A microgrid could access those packs as needed, sharing the power with neighbours during an outage.

THE SMART SWITCH

There's no "central command centre" in a microgrid. Instead, intelligent and semi-autonomous switching components would monitor an area's immediate needs and available resources, and move power when and where it is needed.

SOLAR'S PRICE PLUNGE

Since 2008, wholesale solar module prices have dropped more than 83 percent—opening up new global markets and new applications.



Sources: Bloomberg New Energy Finance, Greentech Media Research, International Energy Agency, Lawrence Berkeley National Laboratory, REC Agents Association, Rocky Mountain Institute, Solamon Energy.

ROOFTOP REVOLUTION

Solar photovoltaic panels aren't just for movie stars anymore. In the United States, Australia, and elsewhere, homeowners, business owners, and whole communities are taking advantage of plunging prices (see chart at left) to deploy panels *en masse*—lowering costs and boosting energy independence. In the United States, a rooftop solar system energizes every four minutes. Down Under, such setups now account for five percent of Australia's total electricity capacity, and in developing economies like India, solar is allowing communities to leapfrog the centralized utility model entirely.

Grid parity, where the cost of rooftop solar with battery storage is less than or equal to rates charged by utilities, is being realized across a wide range of markets. **The United States has achieved parity in the southwest and will hit that benchmark across the board within the next 30 years.** In many parts of the world, rooftop solar is already hollowing out the business model of once-mighty centralized fossil-based utilities. Draw a dotted line and the trend is clear: Big Power is out, small solar is in.

Rooftop solar installation

BRINGING THE ENERGY REVOLUTION HOME

What Canada Needs to Do to Up its Game on the Global Scene

As this document has shown, the global clean-energy opportunity is growing, but Canada is largely looking the other way. While other economies have made clean-energy technologies and services a trade priority, some of us cling to the notion that our carbon-based fuels constitute our only competitive advantage. Here are three things we could be doing to up our game.

1 JOIN THE INTERNATIONAL RENEWABLE ENERGY AGENCY

The International Renewable Energy Agency is an intergovernmental organization that supports countries in their transition to a more sustainable energy future. At the moment, 131 nations are members, including the United States, China, Australia, and many other of our priority trading partners. Canada is not among them.

2 MEANINGFULLY PARTICIPATE IN THE CLEAN ENERGY MINISTERIAL

The Clean Energy Ministerial is the only annual international meeting of cabinet-level energy leaders that exclusively focuses on clean energy. Leaders compare notes on solar and wind adoption, EV charging, smart grids, and more. While other nations send their top people, Ottawa has made a habit of sending mid-level officials.

3 PLAY A CONSTRUCTIVE ROLE IN THE PARIS 2015 CLIMATE TALKS

The next global climate deal will effectively drive the global clean-energy transition. Nations with a record of leadership will have the credibility to shape the talks and win a strong outcome. Before negotiations get underway, Canada needs to be able to show far more progress towards its current climate target, and have made an ambitious national offer for the new deal. We can't afford to be on the outside, or offside.

CANADIAN SUCCESS STORIES

Though Canada could be doing much more to take advantage of the growing global clean-energy market —particularly at the federal level—policy leadership in provinces such as Ontario and Quebec has in recent years effectively lifted our standings in several key rankings. Here's the good news to leave you with:

Thanks to strong growth in Ontario's marketplace, Canada moved up from 12th to a respectable seventh place in the 2013 *Who's Winning the Clean Energy Race?* survey published by Pew Charitable Trusts and Bloomberg New Energy Finance.

In 2013, Canada was the second-fastest growing clean-energy market in the G20 with a 45 percent increase in investment to $6.5 billion. Investment in the wind sector grew by more than 40 percent, to $3.6 billion, and Canada's solar sector also spiked, hitting $2.5 billion in investment—almost 50 percent more than in 2012.

In its most recent *Renewable Energy Country Attractiveness Index*, a global quarterly publication that ranks 40 countries on the attractiveness of their renewable energy investment and deployment opportunities, Ernst & Young boosted Canada into a top-five ranking.

The 150-tonne "Spirit of the Sea" DeltaStream 400 kW tidal-energy generator will enter demonstration service this fall off the coast of Wales. Plans are underway for a 10 MW array of nine DeltaStream generators that would together power 10,000 homes.