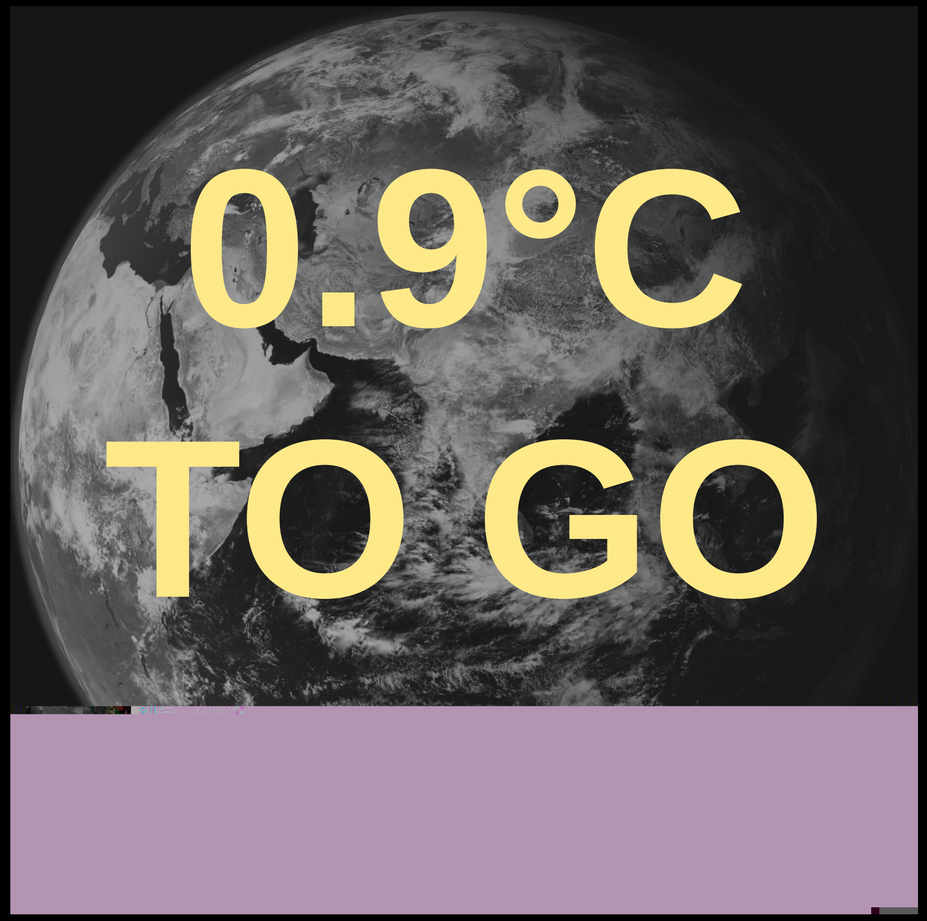
AN ENERGY REVOLUTION FOR A VIBRANT PHILIPPINES AND A LIVABLE PLANET

Reman A. Chua
Vice President
First Gen Corporation
Energy Development Corporation

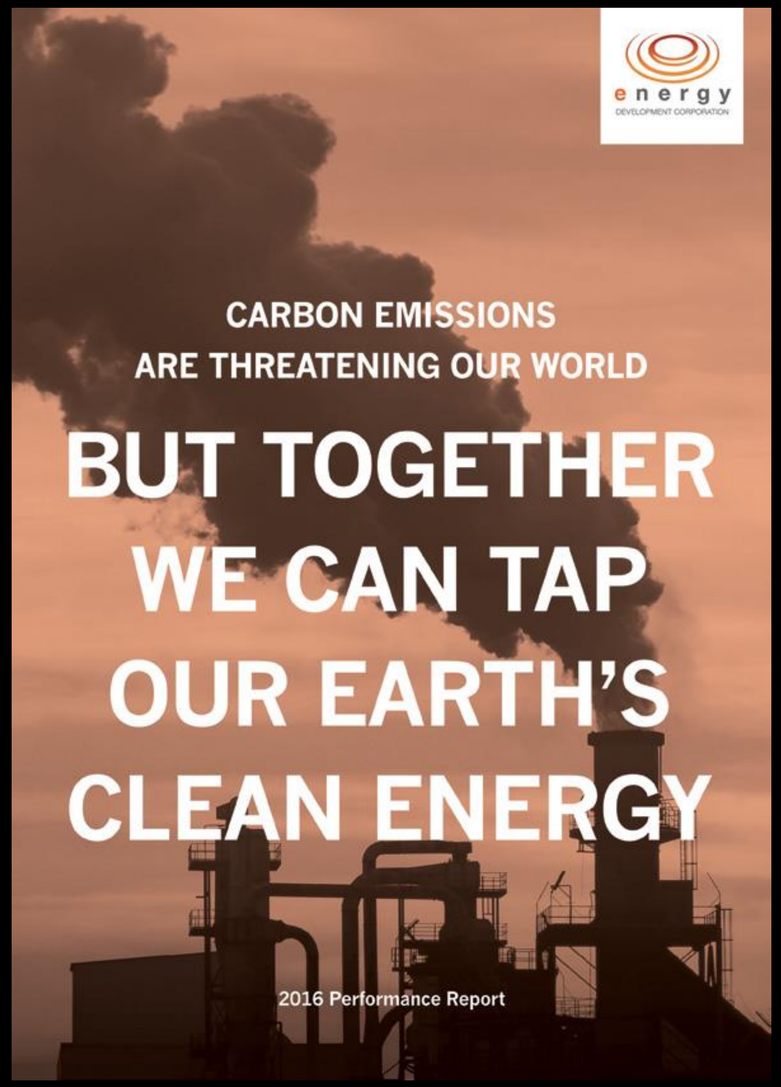
THE WORLD IS NOW 1.1°C WARMER THAN
IT WAS IN PRE-INDUSTRIAL TIMES

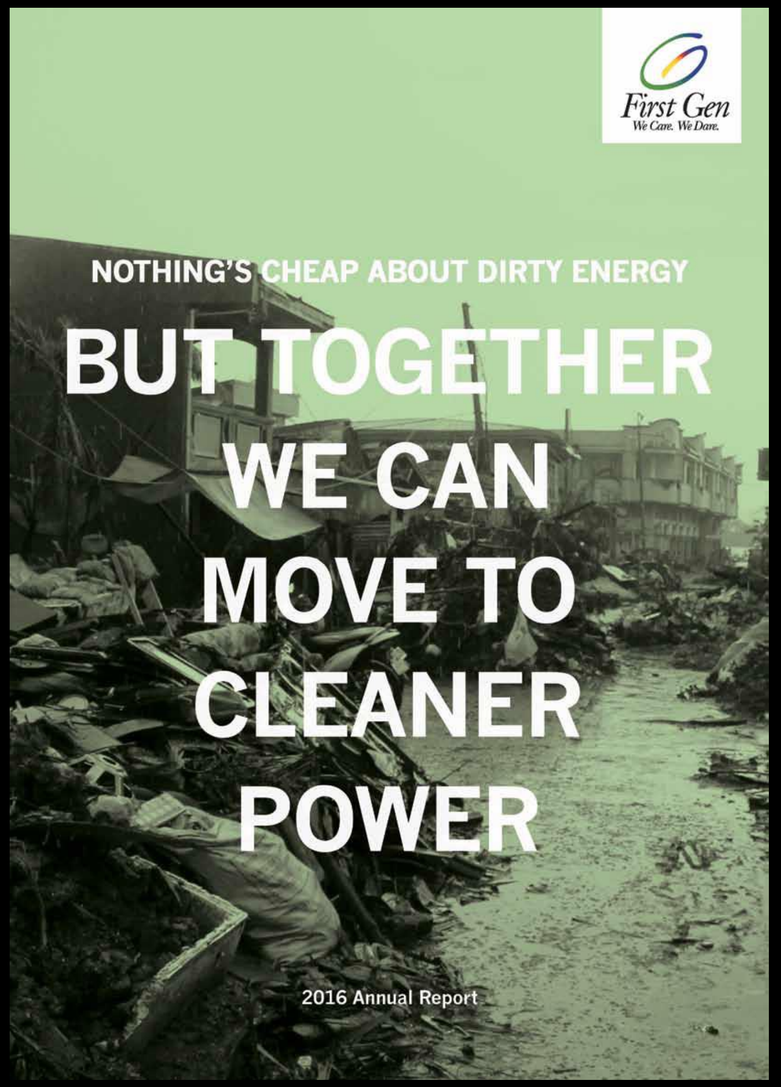


GLOBAL CLIMATE RISK INDEX: THE PHILIPPINES RANKS AMONG THE TOP 5 COUNTRIES MOST AFFECTED BY EXTREME WEATHER EVENTS (1997-2016)

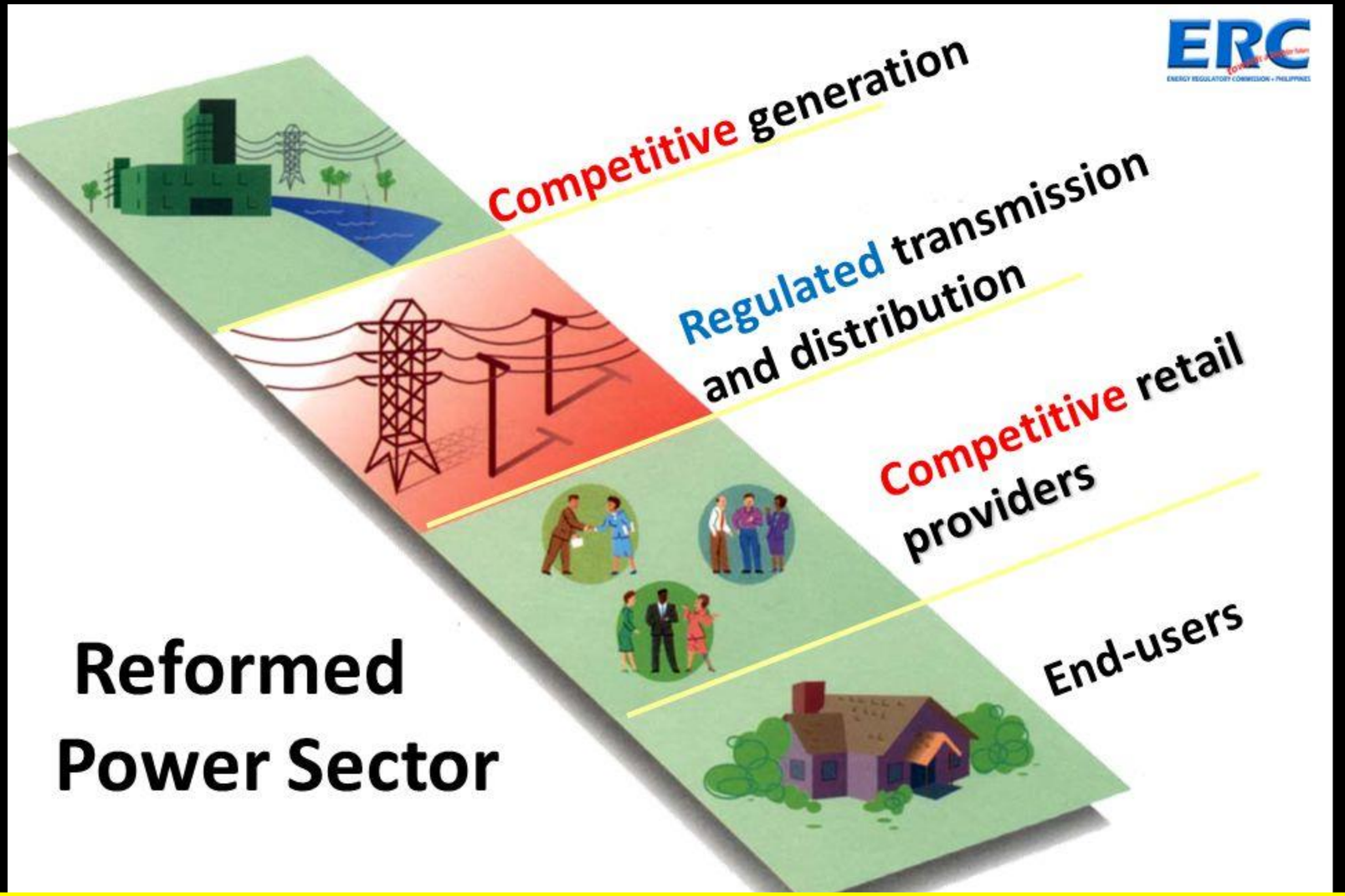
CRI 1997–2016 (1996–2015)	**Country**	**CRI score**	Death toll	Deaths per 100 000 inhabitants	Total losses in million US$ (PPP)	Losses per unit GDP in %	Number of events (total 1997–2016)
1 (1)	Honduras	12.17	301.65	4.28	561.11	1.968	62
2 (3)	Haiti	13.50	280.40	2.96	418.77	2.730	72
3 (2)	Myanmar	14.00	7 097.75	14.55	1 277.86	0.694	43
4 (4)	Nicaragua	19.33	162.45	2.96	234.60	1.127	44
5 (5)	Philippines	20.17	859.55	0.98	2 893.41	0.611	289

BREAKING THE TRADITIONAL MODE





THE PHILIPPINE POWER SECTOR:
intense price competition



PRICE IS STILL THE MAIN DRIVER OF ELECTRICITY CONSUMERS

SHORT TERM PERSPECTIVE OF A GOVERNMENT AMBIVALENT ABOUT CLIMATE CHANGE ISSUES

INQUIRER.NET

Coal here to stay, says DOE chief

PH must balance pressing demands for energy security, environmental sustainability and economic competitiveness

By: Daxim L. Lucas - Reporter / @daxinq

Philippine Daily Inquirer / 01:20 AM November 17, 2016

Coal-fired power plants will remain a permanent fixture—despite the strong lobby against them by environmentalists and proponents of other energy sources—because these could

POWER ADEQUACY AND CHEAP ELECTRICITY REMAIN THE PRIORITY

THE COAL TAX IS A STEP IN THE RIGHT DIRECTION BUT HAS MINIMAL IMPACT

WILL ONLY ADD P0.01 - P0.03/KWH TARRIFF VS. P0.06/KWH (INDIA) AND P0.25/KWH (SOUTH KOREA)

graphics from iremit.com.au

COAL-FIRED POWER PLANTS ARE THE EASIEST TO DEVELOP & THE FUEL SUPPLY THE SIMPLEST TO PROCURE

23 new power plants to go online by 2020

By Iris C. Gonzales (The Philippine Star) | Updated June 15, 2015 - 12:00am

philstar GLOBAL

Home

MANILA, Philippines - The Philippines will have 23 new coal-fired power plants by 2020, Energy Secretary Carlos Jericho Petilla said.

Among the new coal plants that are expected to come online in the next five years are Aboitiz company Therma South Inc.'s 300 megawatt plant in Davao City (2016); The 400-MW expansion of Team Energy's Pagbilao coal fired power plant in Quezon (2017); the 600-MW Redondo Peninsula Energy, Inc. plant in Subic, Zambales (2018); San Miguel Corp. Global's 300-MW plant in Davao (2017) and a 600-MW plant in

STILL MANY COMPETITORS AND EVEN NEW ENTRANTS IN A VICIOUS RACE TO THE BOTTOM

MAJORITY OF BANKS CONTINUE TO FINANCE coal PRODUCTION AND COAL-FIRED GENERATION

MAJOR BANKS FINANCED OVER US$600 BILLION
OF THE TOP 120 COAL DEVELOPERS IN THE LAST FOUR YEARS

WHAT KEEPS US COMMITTED TO THIS GREEN ROAD?

COMPANIES ARE MORE CONSCIOUS OF GREENING THEIR FOOTPRINTS AND SUPPLY CHAIN

OUR GREEN AMBASSADORS

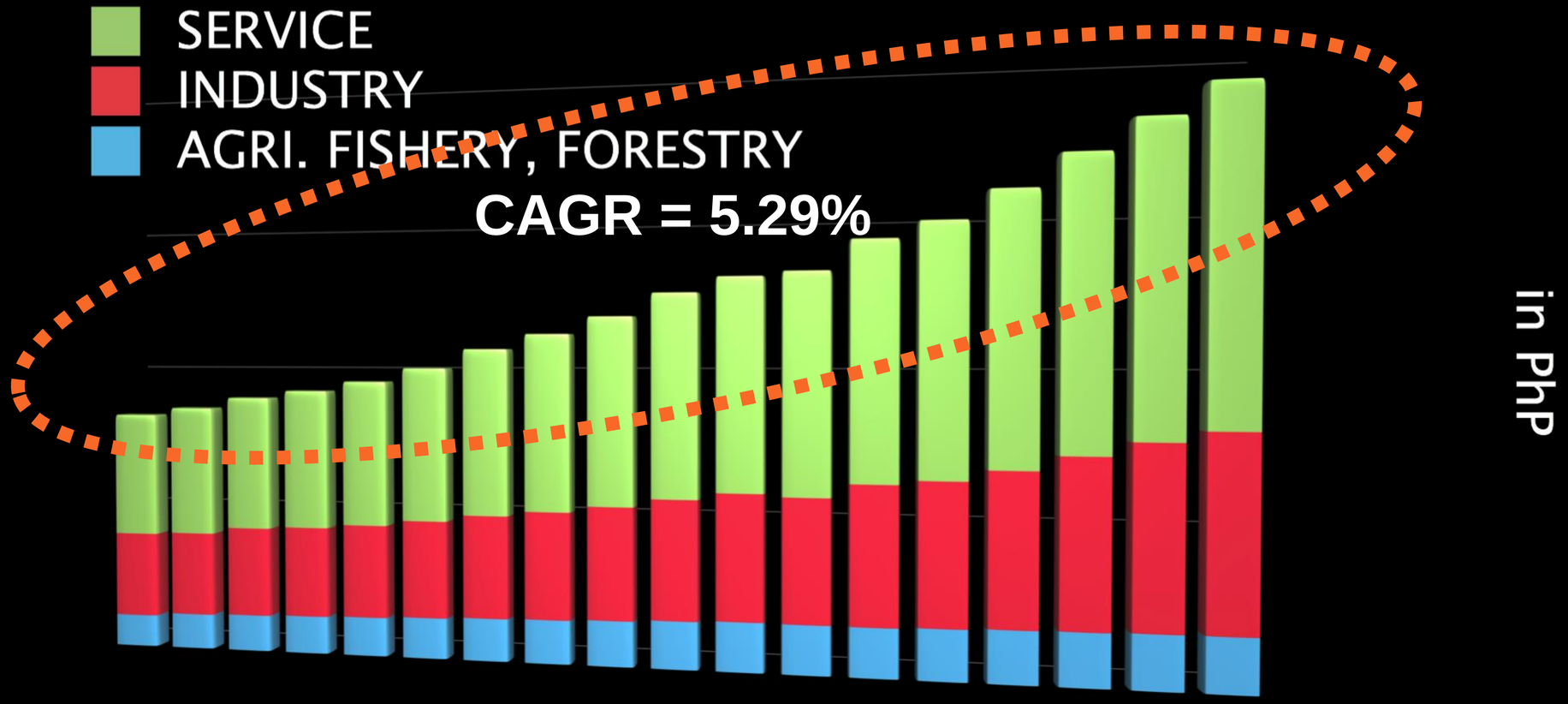
Unilever

AHEAD OF WHAT'S POSSIBLE™

A FEW OF THE RE100 COMPANIES

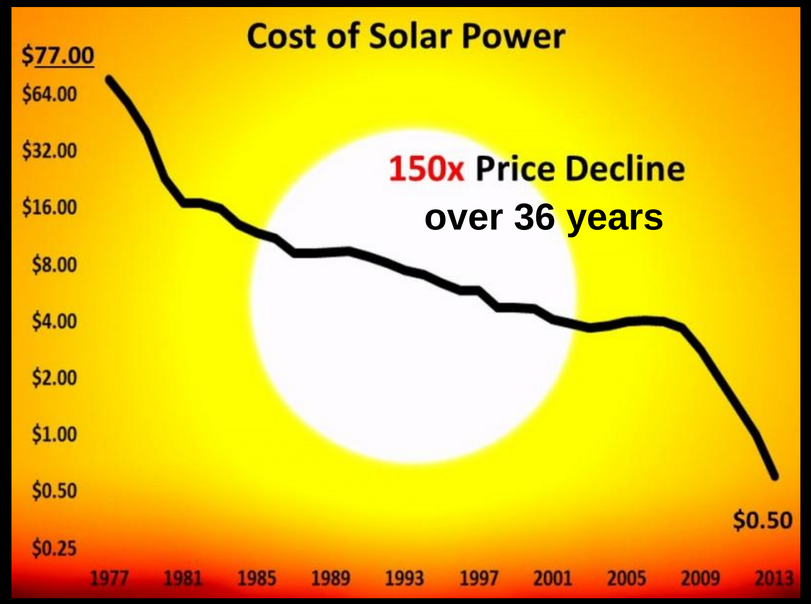
PHILIPPINE GROWTH HAS BEEN DRIVEN BY SERVICES SECTOR WITH LOW CAPACITY FACTOR

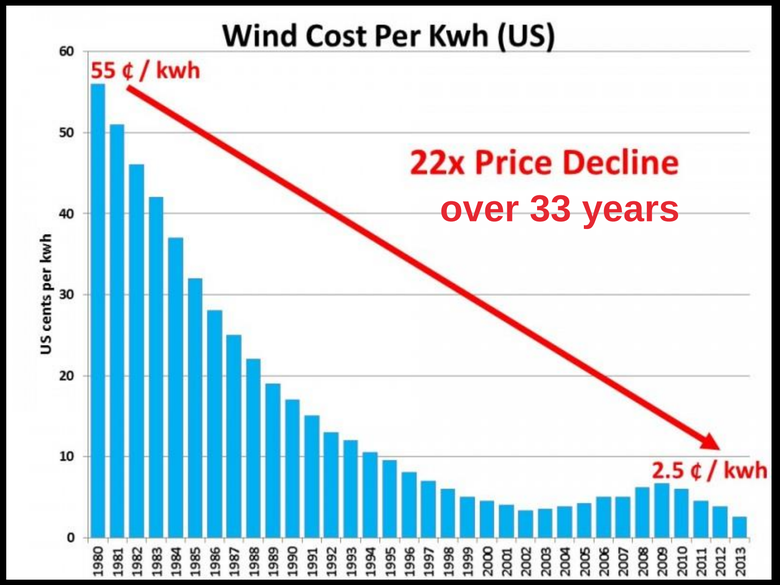
PHILIPPINE GDP PER SECTOR AT CONSTANT 2000 PRICES
1998- 2015 (In PhP)



forces of technology moving very fast

POWER COST FROM SOLAR PV, BATTERIES AND OTHER RENEWABLES CONTINUE TO DROP and DISRUPT ELECTRICITY PRICES





SOLAR PV

150x Price decline over 36 years

BATTERIES

10x Price decline over 14 years

WIND

22x Price decline over 33 years

source: Ramez Naam

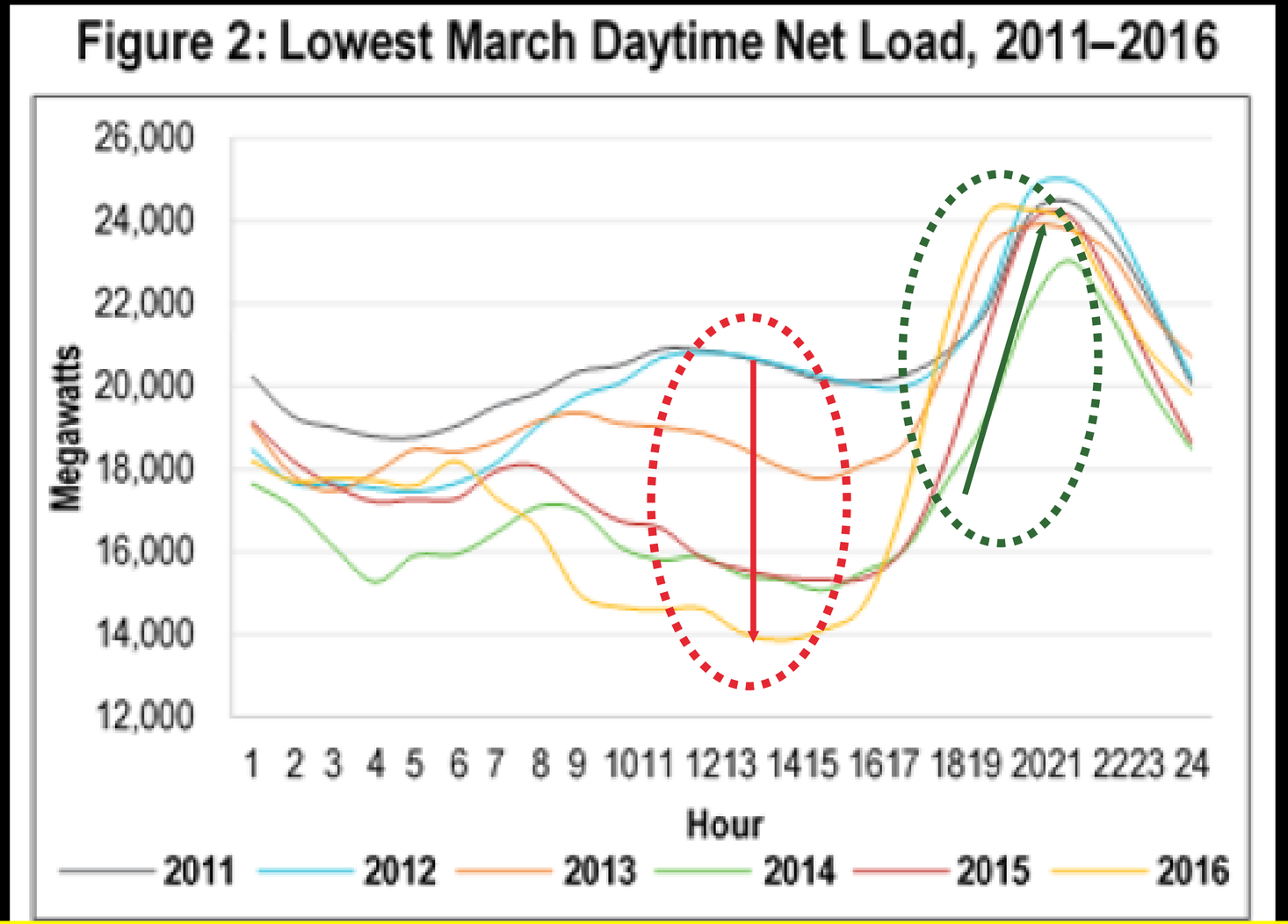
LOWEST SOLAR AUCTIONS PRICES GLOBALLY

RECORD LOW OF $.0242/kwh
IN ABU DHABI (SEPTEMBER 2016)

source: Bloomberg New Energy Finance

EVEN SOLAR PV SOLUTIONS IN MORE FRIENDLY FORMS

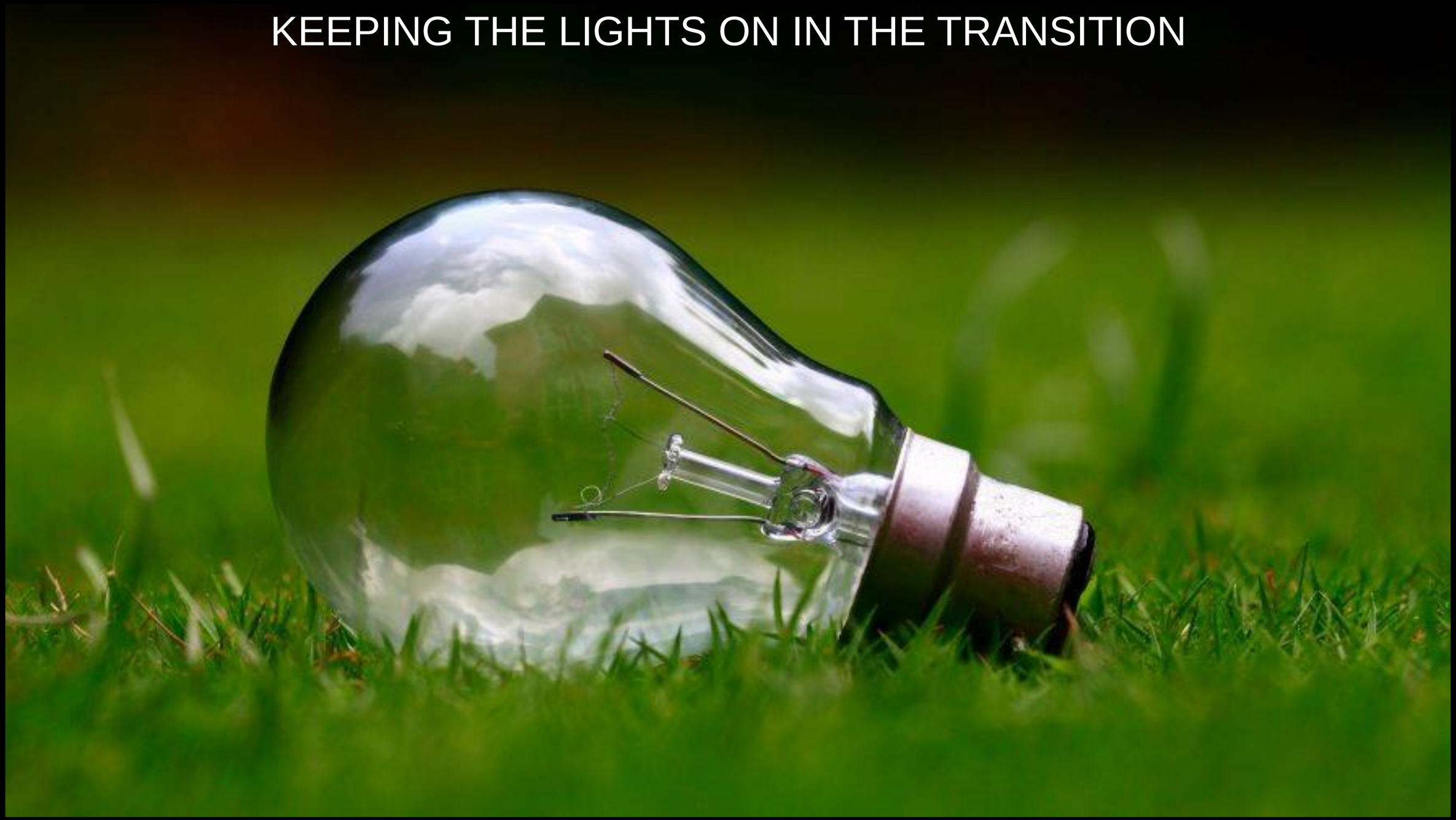
as more renewables come onto the grid
the shape of demand changes



THE DUCK CURVE SHOWS STEEP RAMPING NEEDS

source: ScottMadden Consultancy

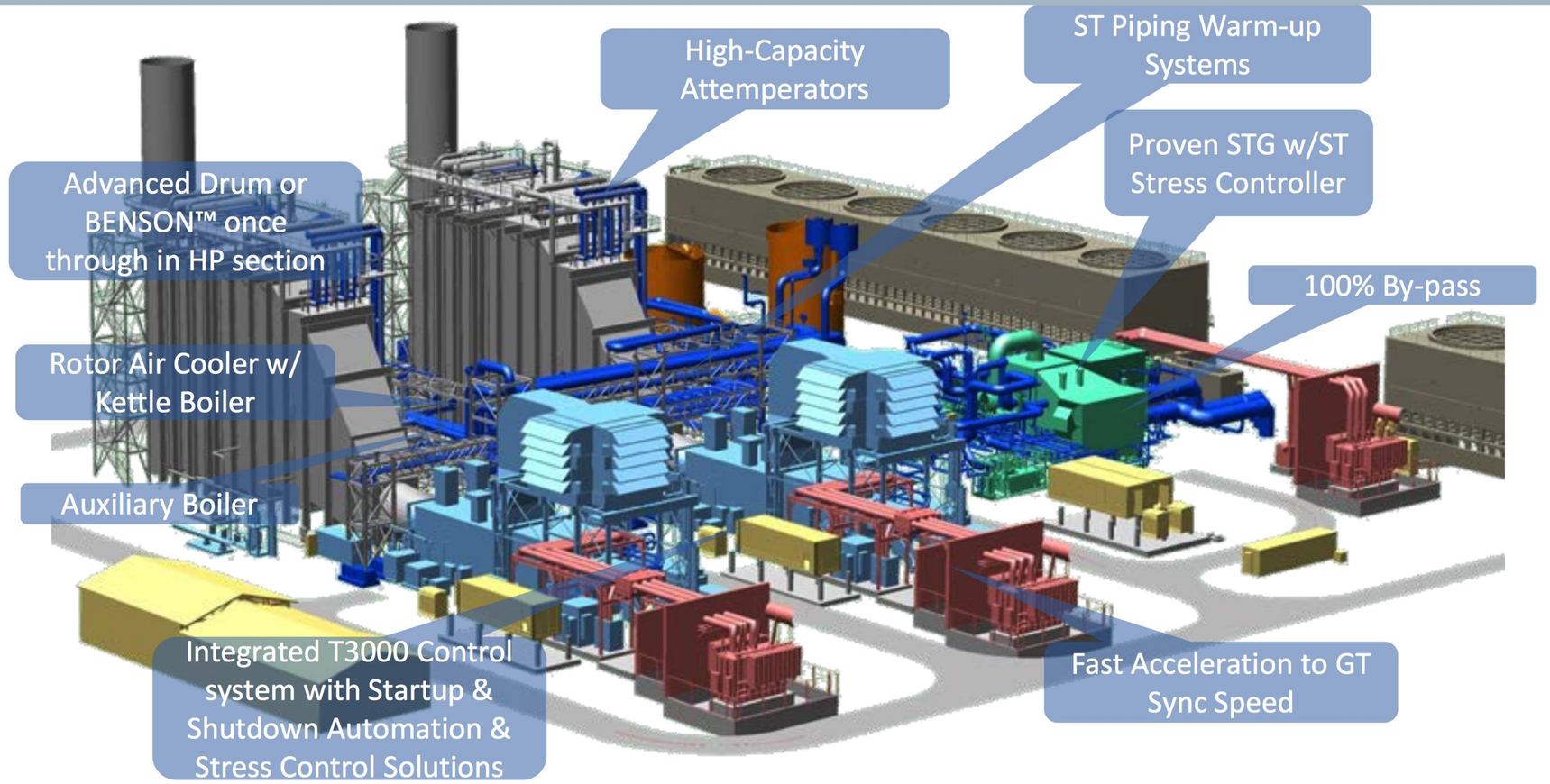
KEEPING THE LIGHTS ON IN THE TRANSITION



need for many tools to help the ELECTRICITY INDUSTRY MANAGE variability and intermittency

SIEMENS

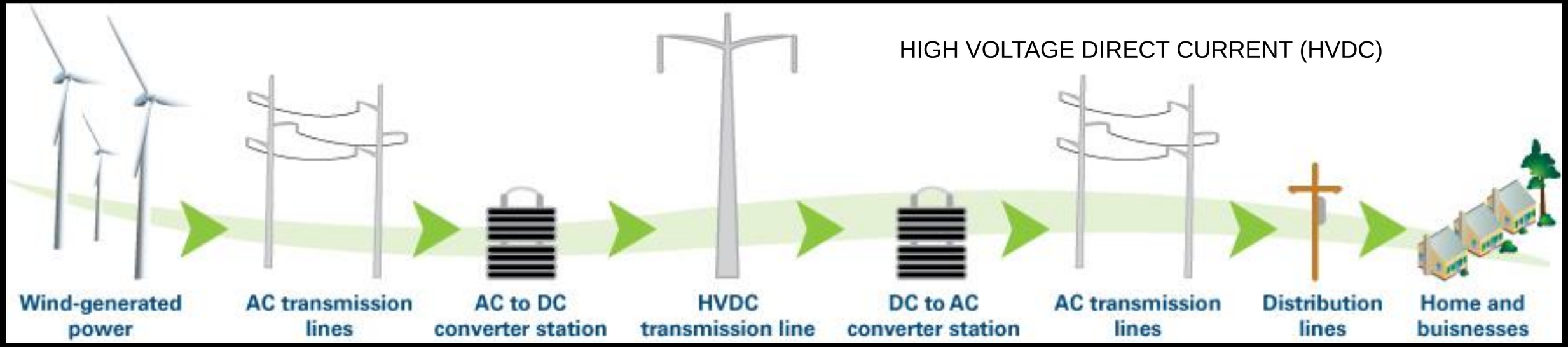
Flex-Plant™ Features for Enhanced Performance

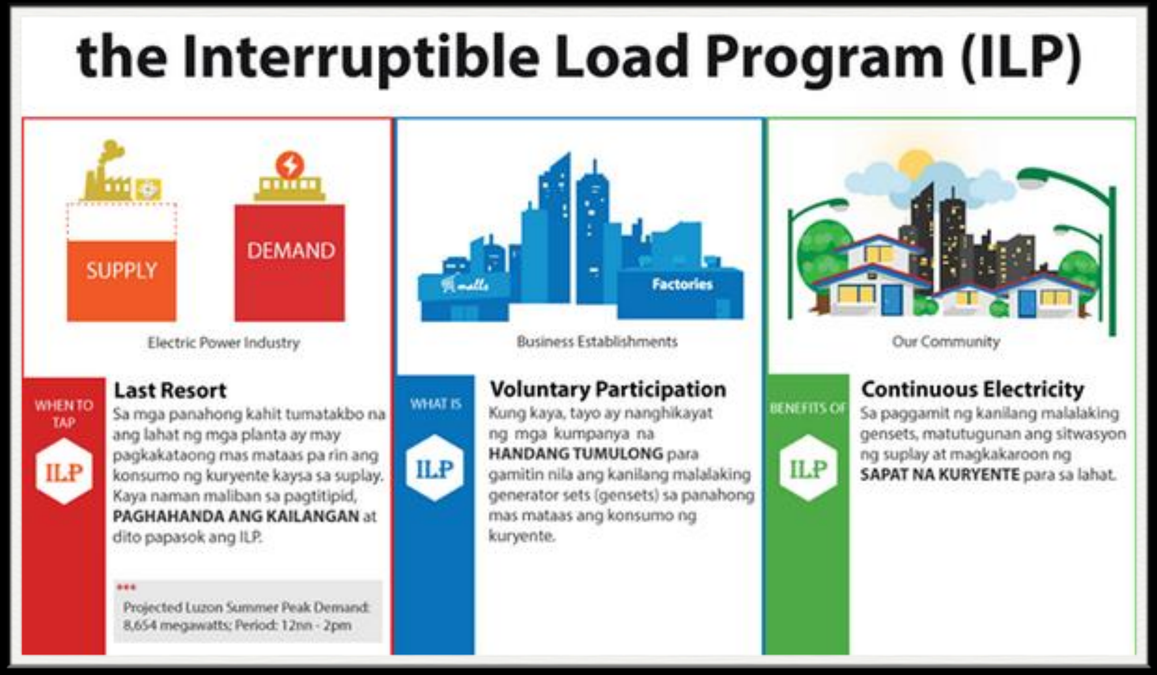


The efficiency and small environmental footprint of a combined cycle with the speed and flexibility of a simple cycle

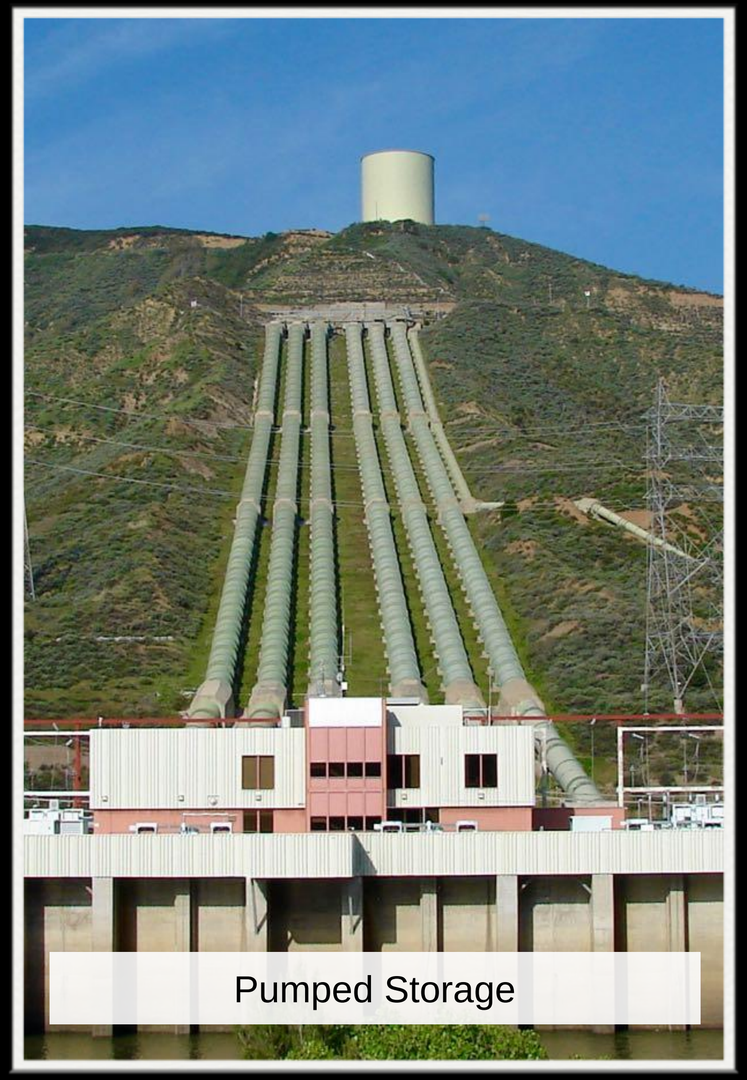
need for many tools to help the ELECTRICITY INDUSTRY MANAGE variability and intermittency

HIGH VOLTAGE DIRECT CURRENT (HVDC)





need for many tools to help the ELECTRICITY INDUSTRY MANAGE variability and intermittency



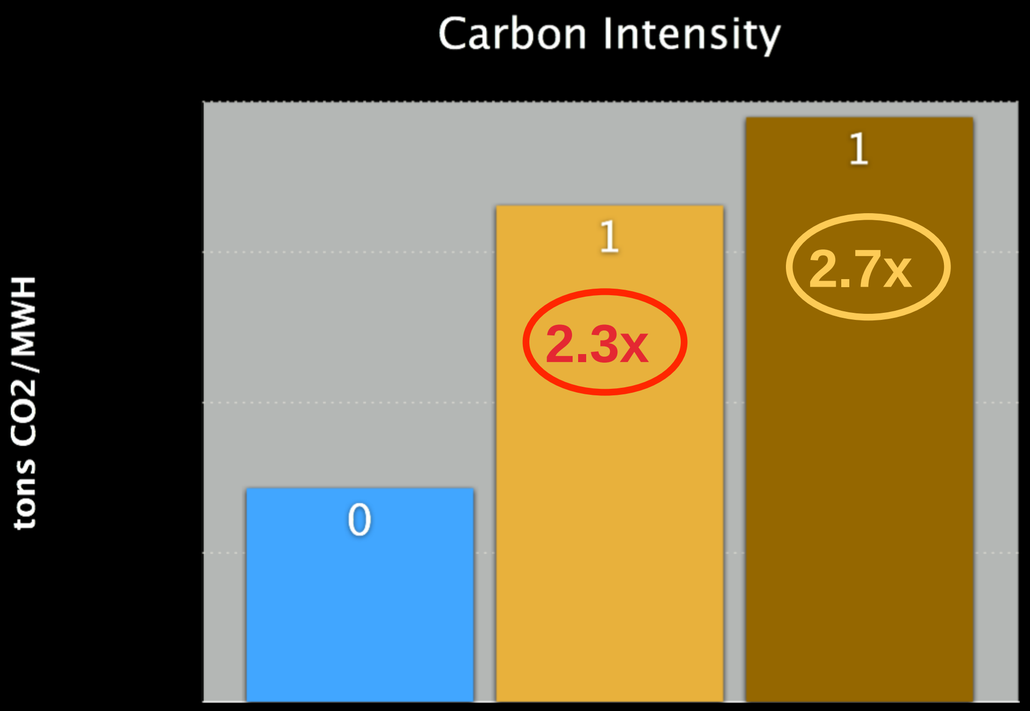
COAL PLANTS CAN'T KEEP UP WITH DEMAND VARIABILITY DUE TO MORE RENEWABLES

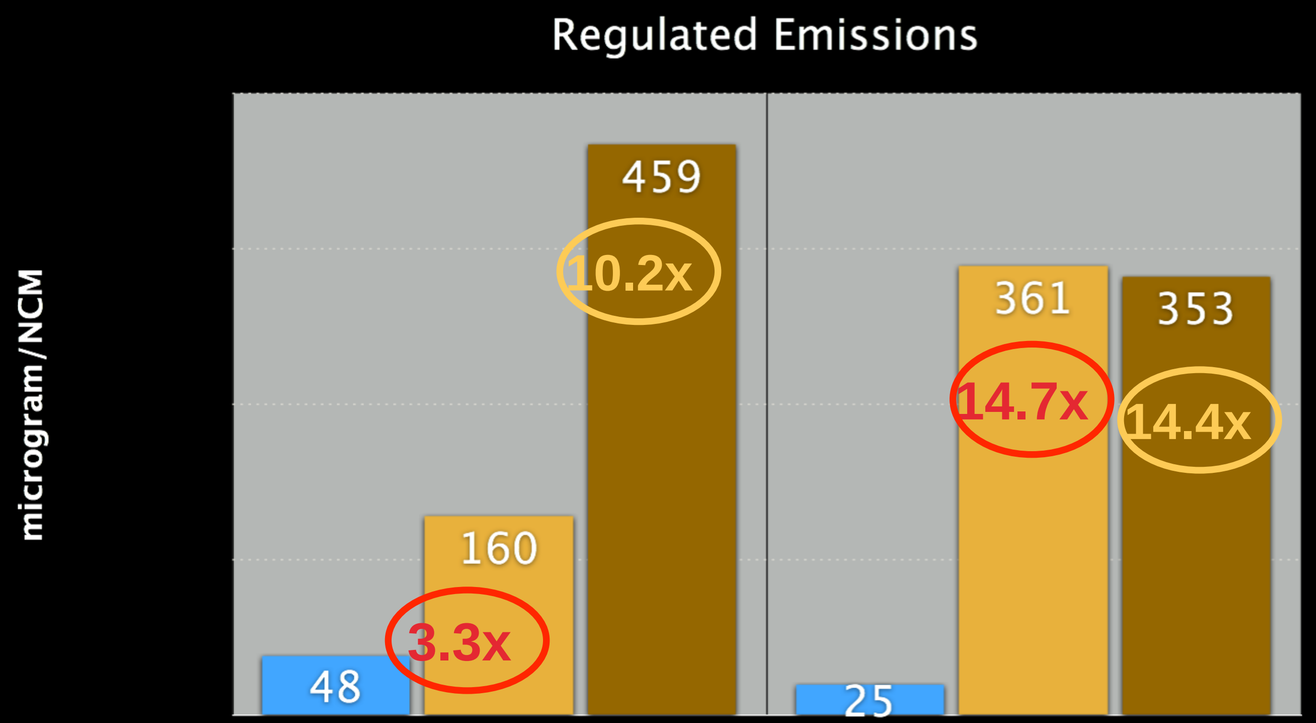
START UP TIME (in minutes)	COAL	COAL (SC/USC)	COMBINED CYCLE GAS TURBINE	SIMPLE CYCLE GAS TURBINE (AERO)
hot	130-300	90-300	**32-45**	**4-13**
warm	205-385	240-480	**95-144**	**4-13**
cold	438-900	438-720	**145-255**	**4-13**

source: Renewable & Sustainable Energy Reviews 2018, Parsons Brickenhoff, First Gen


COAL AND EVEN GAS PLANTS ARE BEING
UTILIZED LESS OR BEING IDLED

COAL PLANT EMISSIONS AND POLLUTANTS ARE DOUBLE OR TRIPLE THAN THAT OF COMBINED CYCLE GAS PLANTS





TRANSPORT SECTOR RAPIDLY MOVING TOWARD EVs

ALEX DAVIES TRANSPORTATION 10.02.17 12:01 PM

GENERAL MOTORS IS GOING ALL ELECTRIC

Business

Volvo becomes the first major car manufacturer to go all electric

share

BUSINESS INSIDER TECH FINANCE POLITICS STRATEGY LIFE ALL

Honda is firing back at Tesla and other automakers by rolling out 2 electric cars by 2018

Cadie Thompson

Aug. 30, 2017, 1:59 PM 20,973

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Hyundai vows to produce longer-range electric car

17 August 2017 Share

Fiat Chrysler to electrify more vehicles as diesels fall out of favor

John Voelcker 66 Comments Jul 31, 2017 Follow John

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Toyota Is Going All-In on Electric Vehicles

The Japanese car company is developing 10 new electric vehicle models.

By Wayne Duggan, Contributor | Dec. 18, 2017, at 10:57 a.m.

Home › Car News › Electric Cars

Lexus goes directly full-electric

Lexus will skip plug-in hybrids in favor of fuel cell and fully electric cars

WITH THE CURRENT

The electric revolution is coming to freighters and cruise ships

electrek

Automakers Alt. Transport Autonomous Driving Energy

DECEMBER 4, 2017

TopGear NEWS REVIEWS BIG READS VIDEOS THE SHOW SHOP

Future Maseratis will be electric. Here's why

FCA fleshes out plan to electrify its future cars, including the gorgeous Alfieri...

Paul Horrell

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Energy / Fossil Fuels

Even cargo ships are going 100% electric

Sami Grover samigrover

December 7, 2017

A new all-electric cargo ship with a massive 2.4 MWh battery pack launches in China

Fred Lambert - Dec. 4th 2017 8:28 am ET @FredericLambert

FINANCIAL TIMES

ANIES MARKETS OPINION WORK & CAREERS LIFE & ARTS

s electric car

Nissan sees 2025 as turning point for electric cars

Oil majors s… domestic utilities

Mercedes-Benz will electrify its entire car lineup by 2022

Posted Sep 11, 2017 by Darrell Etherington (@etherington)

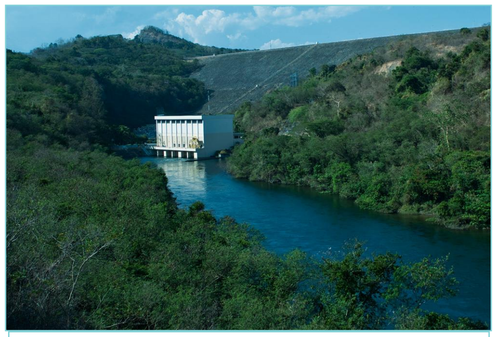
Electric Vehicles + Add to myFT

Hyundai Motor pushes electric car plans as sales slump

Green vehicles key to success in core markets such as China, but offering may be a laggard

image courtesy of The Climate Reality Project

OUR POWER ASSETS



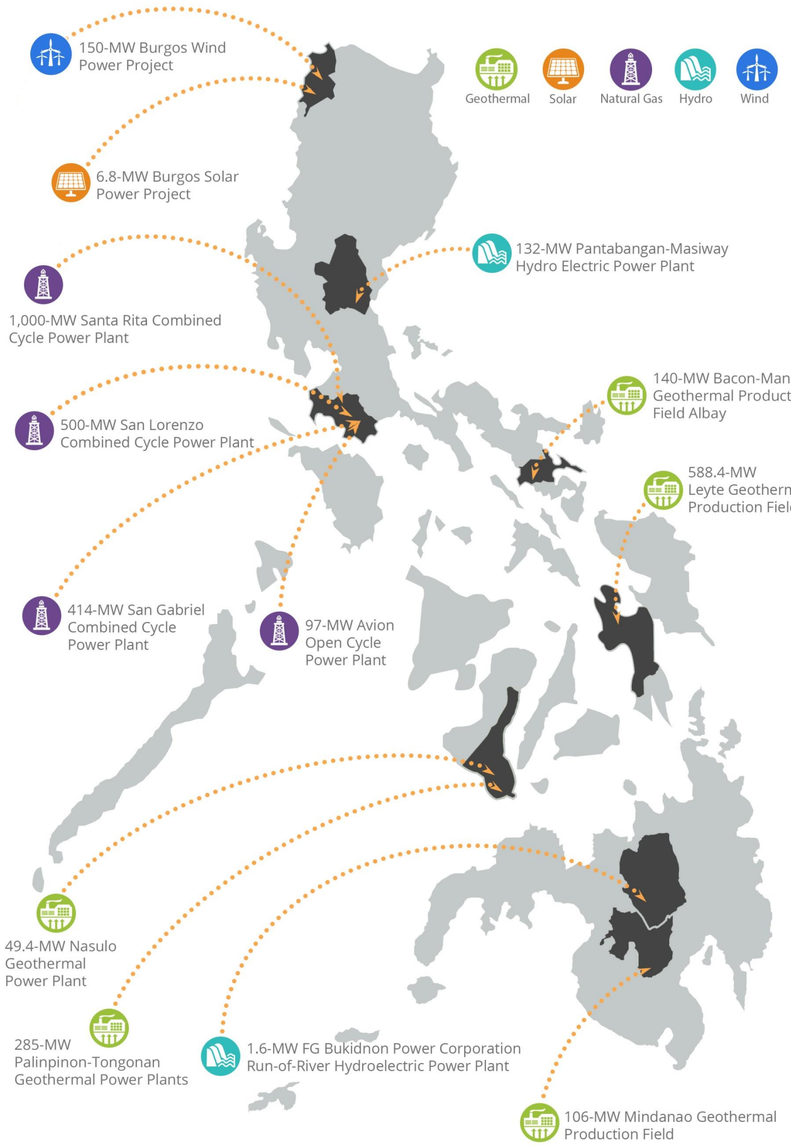
HYDRO: 133.6 MW

NATURAL GAS: 2,011 MW

WIND: 150 MW

GEOTHERMAL: 1,169 MW

SOLAR: 6.8 MW



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energy DEVELOPMENT CORPORATION

ROCKWELL LAND

FIRST PHILIPPINE INDUSTRIAL PARK

First Philec

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