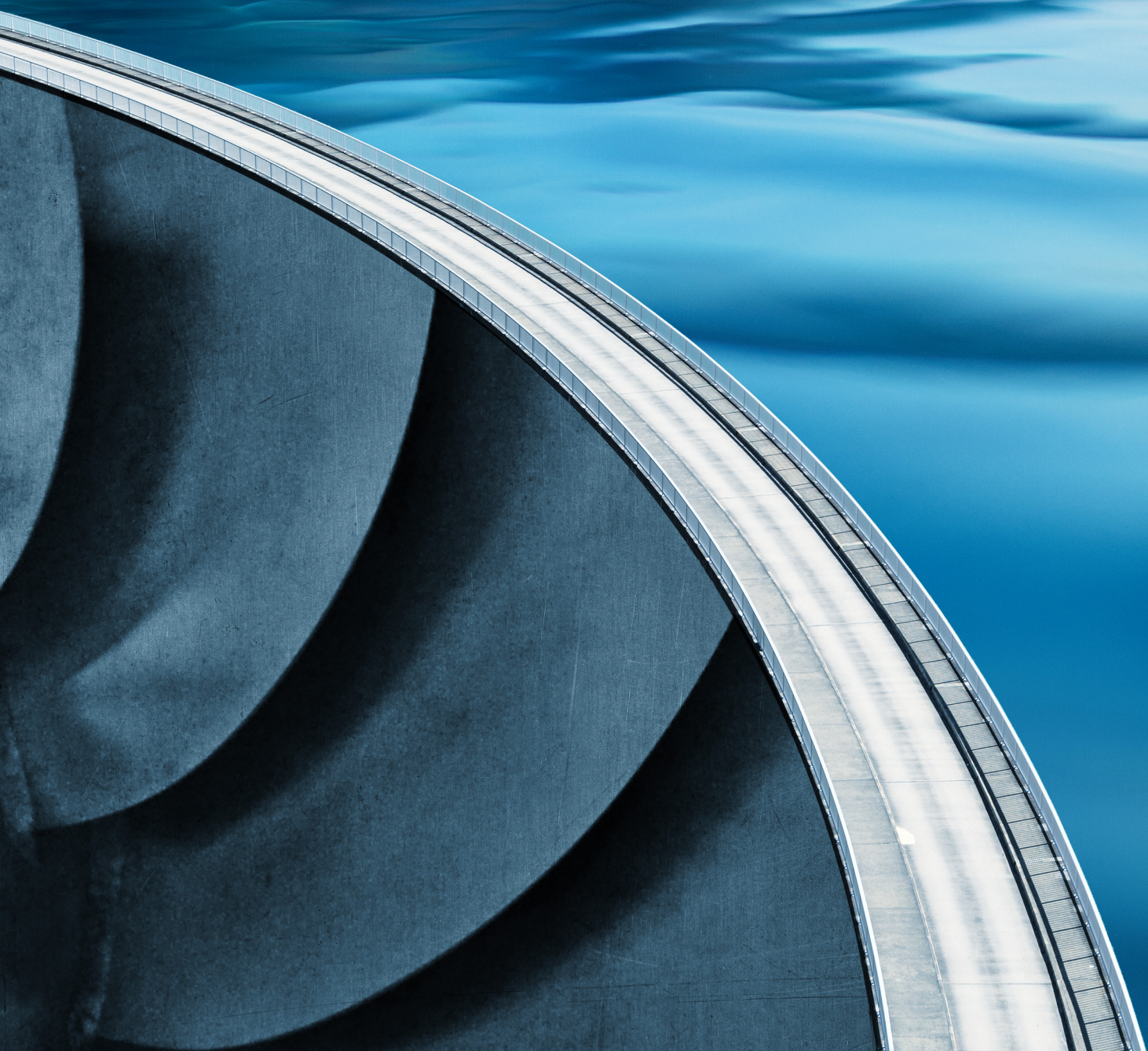
GE RENEWABLE ENERGY

IMPLEMENTING SUSTAINABLE BUSINESS MODELS FOR HYDRO STORAGE



Executive Summary

Countries around the globe have set ambitious renewable energy targets and have grown increasingly reliant on sources such as wind and solar. However, to ensure that production is constantly equal to demand—a mandatory condition on the grid—they must be able to provide power when the wind doesn't blow, or the sun doesn't shine. Conversely, when production is higher than is needed, they can increase overall profitability if they can store the excess. Managing this intermittency requires additional flexibility, and new solutions.

The world's largest renewable energy resource is hydropower, which accounts for roughly 16% of global power generation capacity. More than 10% of the hydro installed base provides hydro storage, making it possible to:

- store great quantities of immediately available potential electricity
- provide greater flexibility and stability to the energy network

For years, hydro storage has offered a cost-effective way to provide large-scale balancing and grid services, with improved predictability on cost and performance. New hydro storage technologies, such as variable speed, give plant owners even more flexibility and quicker response times.

Because they involve both generation and transmission, the business models of energy storage are different from the straightforward investment that can be made into wind or solar production, and investors need to be informed about the specifics.

The three main business models of hydro storage are:

ARBITRAGE

ANCILLARY SERVICES

CAPACITY

Long term policies, regulatory simplification and increased visibility can help utilities and investors better understand the benefits—and their value—that hydro storage provides. A variety of revenue schemes have been implemented successfully globally on which storage stakeholders can rely to make their choice.

FACTS TO KNOW

On a grid,
demand and consumption
must be equal at all times.

2/3

IN THE YEARS TO COME,
ABOUT TWO-THIRDS OF ALL NEW
ENERGY EQUIPMENT WILL COME
FROM RENEWABLE TECHNOLOGIES.

The growth of intermittent renewable sources increases the need for storage to balance the grid.

95%

Hydro storage represents more than 95% of all energy storage today.

HYDRO STORAGE IS A PROVEN, LONG-TERM PROFITABLE INVESTMENT, YET REQUIRING LONG-TERM POLICY TO SUPPORT INVESTORS.

HYDRO STORAGE
IS ONE OF THE MOST
EFFICIENT ENERGY STORAGE
SOLUTIONS BECAUSE
IT IS SUSTAINABLE,
COST COMPETITIVE,
AND LARGE SCALE—BOTH
IN THE AMOUNT OF ENERGY
STORED AND IN TIME OF
STORAGE.

Hydro is the only multi-purpose energy storage resource. It supports:

irrigation & agriculture

water security

flow management

sanitation

GE HAS BEEN IN THE HYDROPOWER INDUSTRY FOR MORE THAN 100 YEARS, HAS THE LARGEST INSTALLED BASE OF HYDRO STORAGE UNITS, AND HAS THE UNIQUE R&D MEANS AND KNOW-HOW TO PURSUE HYDRO'S DEVELOPMENT.

Introduction

> “A next-generation smart grid without energy storage is like a computer without a hard drive: severely limited.
>
> **Katie Fehrenbacher**, GigaOm[1]

Countries around the globe are growing more reliant on renewables to help meet their energy needs, and such variable sources could provide 45% of the power generation worldwide[2] and account for 64% of the new capacity installed over the next 10 years[3]. That variability, in turn, underscores the importance of energy storage. Says the Boston Consulting Group (BCG), “We consider electricity storage to be a key enabler of the large-scale deployment of fluctuating renewable energy generation capacity around the world[4].”

In addition to supporting the integration of intermittent renewables in the grid, hydro storage technology also helps utilities better deal with:

- new operating patterns requiring additional flexibility
- the unpredictability of electricity prices and limited price spread
- additional remuneration through ancillary services

However, since hydro storage is a long-term venture, investors may question the lack of long-term visibility in the energy market, the changing trends in electricity prices, the level at which ancillary services are rewarded, and the competitiveness of hydro storage vs. other solutions, which can be perceived as easier, faster and cheaper to install.

In this paper, we will:

- position hydro on the growing energy storage landscape
- examine how developers can grow their bottom lines with this flexible, efficient, reliable and available technology
- explore how different utilities worldwide have successfully implemented their business models

[1] Christina Valimaki, “It’s Time to Start Appreciating Energy Storage,” Elsevier, 2015.
[2] “Planning for the renewable future - Long-term modelling and tools to expand variable renewable power in emerging economies,” IRENA, 2017.
[3] New Energy Outlook 2018, Bloomberg New Energy Finance.
[4] The Boston Consulting Group, “Revisiting Energy Storage,” 2011.

A look at storage technologies

> “In its Roadmap for a Renewable Energy Future, IRENA (International Renewable Energy Agency) estimates that 150 GW of battery storage and 325 GW pumped-hydro storage is required to double the share of renewable power generation by 2030[5].

When considering investing in a storage solution, several options exist, including lead acid or lithium ion batteries, redox-flow, molten salts, Compressed Air Energy Storage (CAES), and hydro storage.

To decide which solution best suits a need, the technologies should be assessed against several criteria:

- energy production required
- storage capacity required—in quantity as well as in time
- support needed by the grid
- available energy resources
- footprint at hand combined with geological conditions
- available capex
- lifecycle cost
- delivery time
- asset lifetime

Hydro storage offers the following benefits:

- Renewable & sustainable
- Cost effective
- Reactivity
- Scale

[5] IHA, “Hydropower status report 2017”.

DID YOU KNOW?

150+ GW

TOTAL INSTALLED HYDRO STORAGE CAPACITY IN 2017

+95%

HYDROPOWER'S SHARE OF WORLDWIDE STORAGE CAPACITY

30%

OF THE WORLD'S HYDRO STORAGE PLANTS EQUIPPED WITH GE'S TECHNOLOGIES

4+ GW

GE'S ON-GOING HYDRO STORAGE PROJECTS **INCLUDING 2+ GW WITH VARIABLE SPEED TECHNOLOGY**

4 benefits for the energy transition

RENEWABLE
LARGE SCALE
EXTREMELY COST EFFECTIVE
HIGHLY EFFICIENT & REACTIVE

RENEWABLE & SUSTAINABLE

Hydropower is truly renewable.
"All you need is some water and the means to pump it uphill. So while it can't be used everywhere, there are many places in the National Electricity Market where it is possible[6]," said Roger Dargaville in ecogeneration.

Hydropower is truly sustainable.
CAES technology involves compressing and storing ambient air under pressure in an underground cavern. Although its cost is moderate, CAES is fossil fuel-reliant and often is viewed as only an interim solution. The BCG wrote, "We continue to have some reservations regarding this technology because of its continued reliance on fossil fuels, its low efficiency, and its limited operational flexibility[7]."
RenewEconomy wrote about batteries: "Considering that [they] need to be replaced once or twice a decade, with the currently available technologies, a battery facility will need to be replaced a number of times during the potential 100-year life of a hydro storage project[8]." This shorter lifetime, combined with the use of rare materials such as lithium, increase the environmental footprint of the batteries. "Looking beyond scale, you must consider longevity. If batteries are well done, they might be able to store five, maybe ten times the energy that was used to produce them. With pump storage, the energy stored on energy investment (ESOI) is roughly 15 times higher, making it ecologically meaningful as well as highly efficient" said Alexander Schwery, Senior Engineering Manager, GE's Hydro Solutions. Moreover, battery recycling raises questions and costs.

COST EFFECTIVE

Even though the capex is high, as with any large infrastructure project, hydro storage has one of the lowest costs of production and storage in terms of cost/kW, thanks to its lifetime and scale. Wrote NHA's Pumped Storage Development Council, "Fortunately, a technology exists that has been providing grid-scale energy storage at highly affordable prices for decades: hydropower pumped storage. Indeed, for the foreseeable future, hydropower pumped storage stands alone as the only commercially proven technology available for grid-scale energy storage[9]." In ecogeneration, Roger Dargaville relates that hydro storage beats batteries as a storage solution in Australia: "Pumped hydro, on the other hand, is a relatively inexpensive storage technology (already at around $100 per kWh) as it can store large amounts of energy using a very inexpensive material." The ratio between the two is on average, and depending on each project, about 1:10.

[6] Roger Dargaville, "Why Pumped Hydro Beats Batteries as a Storage Solution," ecogeneration, Dec. 2, 2016.
[7] The Boston Consulting Group, "Revisiting Energy Storage", 2011.
[8] Donald Vaughan and Nick West, "Batteries vs. Pumped Storage Hydropower—A Place for Both?" RenewEconomy, June 21, 2017.
[9] "Challenges and Opportunities for New Pumped Storage Development," NHA's Pumped Storage Development Council.

REACTIVITY

The growing share of intermittent sources reduces the inertia of the grid, which increases its instability. Reactivity, then, is key to avoid incidents, and hydropower production and storage can provide inertia and load balancing services to the grid. The current technologies provide response times that are counted in seconds or even milliseconds in the case of variable speed technology.

RenewEconomy compared batteries and hydro storage. It found battery inverter technologies are still catching up in critical areas, such as the ancillary services pumped storage can provide: "... while batteries can provide fast response times, they are yet to demonstrate their ability to provide the full range of ancillary services needed to support the grid. Pumped hydro remains a landmark, proven and reliable technology, able to meet the needs of the grid and provide sustained output for up to a century[10]."

SCALE

This is THE attribute that differentiates hydro storage from the other solutions. For example, Ben Rose wrote in RenewEconomy, "Compressed air storage (CAES) is another technology that is generally about 10 times smaller in capacity than hydro, much more expensive and requires large sealed underground caverns, which are rare[11]."

In part because of scale, batteries address very different needs than does hydro storage. The following table compares the two available mainstream technologies: hydro storage (Linth-Limmern—a hydro storage plant in Switzerland) and lithium ion batteries (Hornsdale Power Reserve—an Australian battery storage facility).

While batteries can fulfill many smaller scale needs—in homes, commercial properties and even cars, for instance—they are not designed for "storing the vast amounts of energy needed for communities and industries to ride through long-term lulls in renewable generation," Greentech Media reports[12]. However, as the IHA wrote, "There is little doubt that both pumped hydropower storage and battery storage will play a fundamental role in future energy systems[13]."

	LINTH-LIMMERN HYDRO STORAGE	HORNSDALE POWER RESERVE BATTERY STORAGE
POWER (MW)	1,000*	100
ENERGY (MWh)	34,000	129
STORAGE CAPACITY (FULL LOAD; HOURS)	34 hours	1 hour 18 min
LIFETIME	100 years	10-15 years
DELIVERY TIME	9 years	100 days
CAPEX (USD MILLIONS)	2,115[14]	50[15]
$/KWh	62	500

*Total production capacity of Linth-Limmern complex = 1,520 MW

[10] Donald Vaughan and Nick West, "Batteries vs. Pumped Storage Hydropower—A Place for Both?" RenewEconomy, June 21, 2017.
[11] Ben Rose, "Pumped Hydro: Storage Solution for a Renewable Energy Future," RenewEconomy, April 2013.
[12] Jason Deign, "Is the Battery Rush Distracting Us from Better Energy Storage Options for the Grid?" Greentech Media, May 12, 2017.
[13] IHA, 2017 Hydropower Status Report
[14] Investment made for the added 1,000 MW of pumped storage.
[15] Steve Dent, "Tesla completes its giant Australian Powerpack battery on time", Engadget.com

Continuing innovation fuels flexibility

Thirty percent of the world's hydro storage plants equipped with GE's technology are in operation or under construction. And with its broad portfolio ranging from 30 MW to 400 MW per unit with heads up to 1,000 meters, GE Renewable Energy has a pump turbine to suit each site configuration. Fast startup times of just 90 seconds for up to 400 MW allow for an increased number of daily starts and stops, adding to flexibility and availability.

GE RENEWABLE ENERGY UNIQUELY PROVIDES ONE OF THE LARGEST OFFERINGS FOR A HYDRO PROJECT, FROM DESIGN TO CUSTOMIZED OPERATION AND MAINTENANCE.

OFFERINGS INCLUDE:

- LICENSING AND PERMITTING
- CONTRACTING
- PLANNING
- CONCEPTUAL ENGINEERING
- SYSTEM INTEGRATION
- PROJECT EXECUTION
- ENHANCED DESIGN AND PLANT INSTALLATION
- CONTROL AND MAINTENANCE
- SERVICES
- REFURBISHMENT AND UPGRADES

> “As renewables continue to penetrate generation, we also expect storage to increase its role in the grid globally. GE Renewable Energy will continue to explore bringing full turnkey solutions to our customers.
>
> **Andres Isaza**, Chief Commercial Officer, GE Renewable Energy

Constantly improving its offerings, GE fosters innovation through shared leadership, best practices, research, support and training. One such breakthrough is variable speed technology, which is included in about half of the hydro storage projects GE Renewable Energy is developing. For a fixed-speed hydro storage plant, there is a fixed power requirement to activate the unit and pump the surplus energy to the higher reservoir for storage. With variable speed, it's as if the unit pump's start/stop switch was replaced by a regulator, boosting efficiency and flexibility. Among the most adaptable production systems, variable speed hydro storage units can store great quantities of immediately available electricity, giving the network greater flexibility, predictability and efficiency. For a unit, variable speed can increase weighted efficiency in turbine mode by an average of 1% and pumping power adjustment range by 30%.

Moreover, by combining the power of water and digital intelligence, GE Renewable Energy can help reduce unplanned maintenance and help manage repair costs.

A HYBRID APPROACH

According to the International Energy Agency, in its Global Energy & CO_2 Status Report 2017, renewable energy grew faster than any other energy source in 2017, and this movement is only expected to accelerate over the coming decades.

The shift to renewables, combined with other transformations in the energy ecosystem, requires new ways of thinking about the existing grid infrastructure, and the ways it can support these changes. One idea: hybrid power solutions, which leverage synergies between multiple generation sources.

Hybrid power plants combine various sources of power generation and storage to accentuate the positive aspects and address the challenges of a specific generation type. They can comprise any combination of one or more renewable generation assets with one another and/or the integration of storage (battery or hydro). Hybrids can even be found where one or more renewable generation assets are combined with conventional generation assets. The result is more affordable, reliable and sustainable power.

An original, yet powerful, combination is floating solar panels installed on hydropower reservoirs. The advantages are numerous:

- sustainable energy production
- ability to use the lake's footprint
- reduced water evaporation from the lake

The business case for hydro storage

> “(...) warehousing energy from diverse resources for use at a different time is only one of the many applications of energy storage. Storage technologies also improve the quality of power through frequency regulation, allow companies to produce power when it is cheapest and most efficient and provide an uninterruptible source of power for critical infrastructure and services[16].

To provide reliable power at the best possible price, utilities need to achieve several missions:

- decrease revenue risk due to lack of predictability
- increase capacity market revenues with higher capacity market bids
- charge when grid frequency is high (production is greater than consumption)
- discharge when grid frequency is low
- collect a grid service fee as incremental revenue

The BCG wrote, “... since a positive business case can be demonstrated for a fair share of storage applications, we believe that there is a bright future ahead of electricity storage in the next decades— driven mainly, but not solely, by the growth of fluctuating renewable energy[17].”

Because hydropower brings different energy services to the grid involving both production and storage, and because it provides many additional benefits such as water management, irrigation control for agriculture, water distribution and water waste control, its business models can appear more complex than those applied by other energy sources.

“Defining the right policy framework to support hydro storage and the financial models to retribute all those benefits are certainly complex, but critical,” said Maryse François, Customer Technology Leader, GE’s Hydro Solutions. Experienced companies such as GE Renewable Energy can act as advisors to help utilities build the right business model, based on their specific situation, as well as advocate for improved regulations.

Energy storage provides a large array of sources of revenues. When combined, based on each specific context, they will bring sustainable profits to utilities and investors.
Revenues can be classified in three main categories:

[16] “Applications of Energy Storage Technology,” Energy Storage Association, 2018.
[17] “Revisiting Energy Storage,” The Boston Consulting Group, 2011.

ARBITRAGE

This involves purchasing inexpensive electric energy to pump water uphill and then, storing it to produce and sell electricity when the price is high. “High volatility between on-peak/off-peak electricity prices drives energy arbitrage opportunities[18],” writes the NHA. As price gaps are volatile, arbitrage is often combined with other services, which bring additional revenues.

CAPACITY

This involves the ability to put quantities of energy on the grid at any time which, according to the BCG, is “one of the most attractive business cases for storage at present.”[18] This service is essential since, at any given time, the quantity of energy produced must be equal to the quantity consumed. It implies that utilities have reserves into which they can tap quickly, thereby increasing the operator’s revenue.

Capacity is usually priced higher, which makes it financially attractive. Depending on location, capacity can be priced per hour with a flexible storage duration, or the hydro storage can be expected to be available for a specified period. Direct agreements between grid operators and plant owners can define the price. With this arrangement, grid stability is safeguarded, while plant operators are ensured a fixed income for the investment. According to the BCG, “The advantage of balancing-energy pricing is that the bulk of the revenue is generated by the commitment to provide energy if and when it is needed. It is not necessarily linked or limited to the actual provision of energy[19].”

Storage helps adjust sudden and fast fluctuations on the grid, but it also can be a profitable solution to manage the longer-term fluctuations of the base load for which utilities tend to use their conventional assets, like gas- or coal-powered plants. With the share of renewables and their inherent variability growing, using less flexible fossil fueled plants to balance the grid in case of shortage is becoming less economical. Moreover, fossil fuels cannot store energy in case of excess. Another economic benefit of storage, especially highly flexible hydro storage, is that it defers or reduces the need to add other sources of generation while meeting grid balancing needs and reducing overall CO_2 emissions.

[18] “Challenges and Opportunities for New Pumped Storage Development,” NHA’s Pumped Storage Development Council.
[19] “Revisiting Energy Storage,” The Boston Consulting Group, 2011.

LET'S LOOK AT A SPECIFIC CAPACITY SCHEME CALLED CAP MARKET.

It involves three components:

- **Cap buyer:** typically, a large energy user who wants to be protected against high energy prices
- **Cap seller:** a large energy provider who wants to get guaranteed revenues for storage capacity
- **Cap price:** an agreed price between the cap buyer and the cap seller

The idea here is that the buyer pays a fixed fee per MWh to the seller. In case the market price goes above the cap price, the seller will have to pay for the difference but he will also be able to sell at that high price the energy stored in its reservoirs. It is a win-win situation in which the storage provided gets revenues, coming in addition to other revenues such as arbitrage-related ones.

With the increasing volatility of energy prices and the growing share of intermittent sources, the need for caps will continue to grow—as will their value—promising a bright future for hydro storage utilities.

Storage also provides load following and regulation services, also called system reserves. According to the NHA, "... the need for system reserves at night is increasing to ensure adequate grid stability with higher percentages of variable renewable energy generation, including the demand for energy absorption capabilities during periods of high wind generation during low load (demand) periods. In addition to energy absorption needs, with the increased amounts of variable renewable energy being supplied at night while load is decreasing, there is a complimentary greater need for load following and regulation services to accommodate the greater changes to net load on the system[20]."

Another service that has proven to bring in significant returns is spinning reserves, the extra generating capacity that is online but unloaded and available to respond within minutes when there is an outage.

ANCILLARY SERVICES

The Federal Energy Regulatory Commission (FERC) defines ancillary services as: "those services necessary to support the transmission of electric power from seller to purchaser given the obligations of control areas and transmitting utilities within those control areas to maintain reliable operations of the interconnected transmission system." These operations, which go beyond generation and transmission, help maintain grid stability and security while supporting the continuous flow of electricity so that supply will continually meet demand. They include frequency control, voltage control and black starts (restarting a power plant after a full blackout).

Today, with the onset of intermittent sources, large-scale balancing is needed globally to address momentary differences caused by production fluctuations.

[20] "Challenges and Opportunities for New Pumped Storage Development," NHA's Pumped Storage Development Council.

Successful models across the globe

> “Thanks to the flexible mode variable speed hydro storage plants offer, utilities are able to react fast and capture the lucrative sweet spots when prices of electricity are highest. Our customers’ dispatchers of electricity really love the flexibility and reactivity of the machines.

Bill Armstrong, Europe General Manager, GE’s Hydro Solutions

Hydro storage is the most used storage solution across the world, and countries have implemented models built upon the combination of the three main revenue sources described above.

CHINA

To address a growing need for clean energy, China needs an increased share of renewable sources. China is the leading hydro region. It has been building large plants such as Three Gorges, Xiangjiaba, and Sonla, to name just a few.
To accommodate its increasing share of wind and solar sources, China has planned to add 60 GW of hydro storage by 2020 in the 13th Five Year Plan.
It already has highly efficient assets such as the Hohhot power plant, designed to complement wind farm production while providing the grid with power for peak demand, supplemental power for periods of reduced production, and energy storage for emergency power standby and frequency regulation.
GE Renewable Energy designed the pump turbines and motor generators specifically to provide:

- a higher stability while operating over a large head range
- the ability to withstand load and thermal cycles due to frequent starts and stops
- a higher availability to cope with demand from the grid

NORTH AMERICA

Renewables are growing at a fast pace in North America. In 2016, the Department of Energy issued the "Hydropower Vision: A New Chapter for America's 1st Renewable Electricity Source" report, which stated "that U.S. hydropower could grow from 101 GW of capacity to nearly 150 GW by 2050. Growth under this modeled scenario would result from a combination of 13 GW of new hydropower generation capacity (upgrades to existing plants, adding power at existing dams and canals and limited development of new stream-reaches) and 36 GW of new pumped storage capacity. If this level of growth is achieved, benefits such as a savings of $209 billion from avoided greenhouse gas (GHG) emissions could be realized, of which $185 billion would be attributable to operation of the existing hydropower fleet."

A concrete example detailing how hydropower makes the difference can be found in California. The state meets about half of its demand in electricity with solar production during the day. When the sun goes down, 13 GW are needed from other energy sources within three hours. With this fragile system, grid studies show that a blackout can occur if just one big unit goes down during the afternoon. This risk could lead to questions about the further development of intermittent energy sources. To sustain its energy policy largely built on solar resources, California is looking into flexible and large-scale storage solutions, which only hydropower can provide.

EUROPE AND MIDDLE EAST

A good example of reserve capacity mechanism can be found in Portugal. The country now gets more than half of its electricity from renewable sources and relies on hydro storage plants, such as Alqueva II and Salamonde II, to ensure the grid's stability. Building on those successes, Portugal launched an ambitious plan for an additional 7,000 MW of hydropower.

Well-defined ancillary service markets also have been developed by European countries. Take GE's first variable speed hydro storage plant, Linth-Limmern in Linthal, Switzerland. It can generate up to 1,520 MW—as much renewable electricity as a nuclear power plant. Most importantly, the plant acts as a giant natural battery, storing up to 34 GWh, the equivalent of 340,000 fully charged electric cars. It is highly flexible and efficient: Only 120 seconds are needed to start up the plant, just milliseconds to add 100 MW on the grid, and 270 seconds to switch from pump to turbine mode with an overall cycle efficiency of more than 80%. Said Bill Armstrong, Europe General Manager for GE's Hydro Solutions: "Linth-Limmern is giving the Swiss network great levels of flexibility and stability. This plant will be central in the energy management of Switzerland for decades to come and will become a global reference for energy storage."

Net revenues from spinning reserves for three European countries show that flexible hydro storage was a significant leader in 2016 when compared to other energy sources. A study from IHS Markit drew the profiles of several European countries.
The analyzed data showed that hydro generated 2.5 to 3.5 more reserve storage revenues than any other type of fuel[21].

Israel is another example of how hydro storage can support a nation's energy plan. Operating on a stand-alone independent grid that requires stability and high flexibility, Israel decided to balance solar production by building hydro storage power plants, two being already under construction (Gilboa and Kokhav Ayarden). GE's full turnkey solutions included engineering, procurement and construction. For those two plants, GE Renewable Energy will cover the full day-to-day operation and maintenance for 20 years, improving performance and reducing operational risks. This guarantees tariff-setting performance to GE's customers and is a concrete example of how GE can work with its customers all along the value chain.

[21] "Balancing the European power grid. Country Profiles", IHS Markit Multiclient Study, October 2017.

Conclusion: A holistic approach to the business of energy storage

> “Hydro storage technology is an enabler for the transition and modernization of 21st century power generation. It provides production, storage and grid stabilization. Moreover, it brings a critical benefit that distinguishes it from the others—water management.
>
> **Pascal Radue**, President and CEO, GE’s Hydro Solutions

A holistic approach that promotes innovation and is based on all energy sources will keep costs down and make energy production more reliable than ever.

Storage is essential to the stabilization of energy networks. The choice of technology is driven by needs that are based on geography, application, financing and timing. Hydropower combined with pumped storage technology is one of the most cost competitive, large scale—both in the amount of energy stored and in time of storage—predictable, efficient and sustainable energy storage solutions. It’s a powerful asset to provide grid-scale services, thereby supporting the energy transition taking place all over the world.

Depending on the country or region, a variety of remuneration schemes are available. “There is no perfect model in any country or region, but best practices—such as reserve capacity mechanisms, ancillary services and spinning reserves—demonstrate the efficacy of hydro storage to stabilize the grid and how it can benefit investors and plant owners,” said Maryse Francois, Customer Technology Leader of GE’s Hydro Solutions.

Trusted companies like GE Renewable Energy, which has the largest hydro installed base in the world and is committed to overall plant performance, can work with each customer to help determine the right technologies and remuneration schemes to create a sound business investment.