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An Uncertain Future for Nuclear Power in Europe

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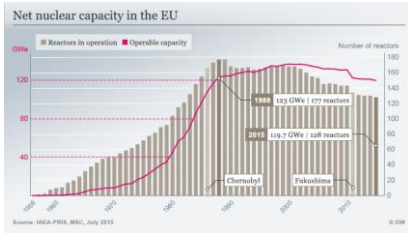


EU Nuclear Construction

Temelin Nuclear Plant
Czech Republic

Prior to April 26, 1986 the outlook for nuclear power in Europe was bright. France, the U.K., Russia and others had major plant construction programs underway that promised to provide lower cost plentiful electricity. However, the Chernobyl nuclear disaster was the turning point. That one accident changed forever the idea in the minds of some leaders that nuclear power for electrical generation was safe. This caused a number of plants to be cancelled, some under construction.

Whether the appropriate safety features or systems were integrated into the Chernobyl design, has been discussed at length. But, the result of that catastrophic incident, and the 2011 accident in Fukushima, Japan, has forever changed the landscape for nuclear power throughout the world.

In the years since, the aged reactors in Europe have become a point of controversy, with many European countries moving away from nuclear power. European leaders and citizens are now motivated by concerns for construction costs, public safety and a desire to move to renewable-based (wind and solar) electrical generation.

However, the reality is that approximately one-third of the European Union's electricity (kWh) is generated by nuclear power. Based upon 2015 data *(latest information available)*, France leads the way with 76.3 %, followed by the Ukraine (56.5%), the Slovakian Republic (55.9%) and Hungary (52.7%).

Nuclear Power Plants in Europe

As of November 2016 there were 186 operating nuclear power generating units in Europe with an installed net capacity of 163,685 MWe. In addition, 15 units with a net capacity 13.696 MWe were under construction in six (6) countries.

Country	In Operation		Under Construction	
	Number	Net Capacity MWe	Number	Net Capacity MWe
Belarus	-	-	2	2.218
Belgium	7	5.913	-	-
Bulgaria	2	1.926	-	-
Czech Republic	6	3.930	-	-
Finland	4	2.752	1	1.600
France	58	63.130	1	1.630
Germany	8	10.799	-	-
Hungary	4	1.889	-	-
Netherlands	1	482	-	-
Romania	2	1.300	-	-
Russia	36	26.557	7	5.468
Slovakia	4	1.814	2	880
Slovenia	1	688	-	-
Spain	7	7.121	-	-
Sweden	10	9.651	-	-
Switzerland	5	3.333	-	-
Ukraine	15	13.107	2	1.900
United Kingdom	15	8.918	-	-
Total	**186**	**163.685**	**15**	**13.696**

Source: European Nuclear Society

The Nuclear Energy Statistics

Even after the Chernobyl disaster, from 1990 to 2015, most of the countries operating nuclear facilities increased their production of nuclear power: the Czech Republic (+113.3 %), France (+39.3 %), Slovakia (+25.8 %), Slovenia (+22.2 %), Finland (+21.0 %), the Netherlands

An Uncertain Future for Nuclear Power in Europe

(continued)

(+16.4 %), Hungary (+15.3 %), the United Kingdom (+7.0 %), Spain (+5.6 %), Bulgaria (+4.9 %) and Romania (which started operation of its nuclear facilities in 1996). The remaining countries decreased their production of nuclear power, with Germany recording the most significant decrease in absolute terms (-60 682 GWh), followed by Lithuania (-17 033 GWh) which ceased operation of its nuclear facilities in 2009. Other countries reducing their production of nuclear power within the same period were Belgium (-16 619 GWh) and Sweden (-11 837 GWh).

Nuclear Safety

The Chernobyl plant incident was a man-made disaster. There was a tremendous loss of life with long-term adverse environmental consequences. Could it have been averted? With more emphasis in the initial design and application of safety systems and procedures, it may well have.

The only other major nuclear plant incident (Fukushima, Japan) was the result of an unforeseen act of nature (tsunami). Here too, additional emphasis on safety systems in the design may well have mitigated the damage. Does this mean that nuclear power is safe? The historical record would tend to say yes, IF we put the appropriate emphasis in the design and construction phases. But, construction costs and fuel reprocessing are still significant issues that need to be address.

The Nuclear Dilemma

Nuclear power has provided many of the European countries with reliable electricity for over two decades, while having a minimal environmental impact. However, accelerated construction costs, concerns for safety and fuel reprocessing have caused some leaders to begin replacing nuclear power capacity with other sources. The replacement sources most often cited are wind and solar. At first glance this would appear reasonable. However, these and other sources are not without their concerns. For example, wind and solar have environmental concerns (available space, bird strikes, etc.). In addition, they do not provide the reliability of base-load generating sources (fossil fuel or nuclear power). Their erratic generating profiles impose a new set of demands on utilities addressing reliability and customer demands.

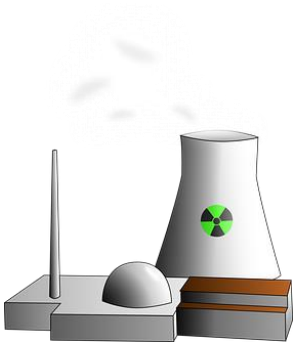
Moving to coal-based generation has been mentioned as an alternative for Germany. While lower cost than nuclear power, this raises the ire of strict environmentalists. A cleaner burning fossil fuel source would be natural gas. While some countries have notable supplies, most are already importing from the Russian Federation. A move to natural gas based generation would make them even more dependent upon a foreign country for their energy supply.

Summary

All industrialized countries depend upon reliable affordable energy to maintain their economy. European countries are at a crossroad. Each energy source for the generation of electricity has benefits and liabilities. Leaders must strike a balance between safety, environmental concerns, reliability and how dependent they want to be on sources outside of their borders. What part nuclear power will play in this still has to be determined.

Sources: *International Atomic Energy Agency*
European Nuclear Society

The area adjacent to the Chernobyl Plant site will continue to be uninhabitable for some time.



French Nuclear Power Plant

U.S. Reverses Stance on Clean Power Plan

IEP Staff Writer

Administrator Pruitt Signs Repeal of Clean Power Plan Restrictions on Coal-Fired Power Plants
(Source: EPA)

In 2015 the U.S. finalized the Clean Power Plan (CPP), an effort by the administration to force states to move away from coal-fired power generation to sources with lower carbon emissions. The regulations, implemented through Environmental Protection Agency (EPA), had a severe economic impact on coal-producing states.

Under the Clean Power Plan emissions targets for power plants were set *assuming* utilities could meet the objectives by improving the efficiency of existing coal units; replace coal-fired generation with natural gas, and adding more renewable energy to their power grids.

Coal-Fired Power Plant

The EPA's emissions targets were based upon the assumption that taking actions *outside* of the plants would be required, such as replacing coal-fired generating capacity with wind or solar farms. The plan was immediately challenged in court by industry groups and more than twenty (20) states. Their challenges focused on the technical feasibility of the emissions targets and that EPA exceeded its legal authority in an effort to limit greenhouse gas emissions from power plants. In 2016 the U.S. Supreme Court blocked the regulations from going into effect while the lawsuits were pending.

In a move that essentially rescinds the Clean Power Plan, on October 9th the EPA Administrator (Mr. Scott Pruitt) signed a measure to repeal the previous administration's policy. He stated that the benefits of the proposed regulations were overstated by factoring in the gains from curbing global warming in other countries, as well as from reducing harmful air pollutants other than carbon dioxide. Mr. Pruitt said that repealing the regulations will "...facilitate the development of United States energy resources and reduce unnecessary regulatory burdens associated with the development of those resources. By not complying with the proposed regulations it has been projected that the $33 billion would be saved.

Source: NY Times October 9, 2017

Lighting – Is it Getting too Complex?

By: Thomas D. Mull, PE, PEM, CEM

LED Downlight
Picture Courtesy of Cree

Is technology outpacing our illumination needs? For years incandescent and fluorescent fixtures controlled manually, or by timers, were pretty much the norm. In the early 70's we started focusing on improved control strategies and source efficacies. In the past four decades we have seen advancements in technology that have provided new sources that are 80% more efficient than equivalent incandescent lamps and strategies that allow us to control fixtures from our smartphones. So, where do we go from here?

In coming issues we will examine technological trends in lighting considering the primary purpose of a lighting system and the fact that the operating cost of lighting systems is becoming an ever ***decreasing*** part of our overall energy expenditure.

Southeast U.S. Leads in Crude Oil Production

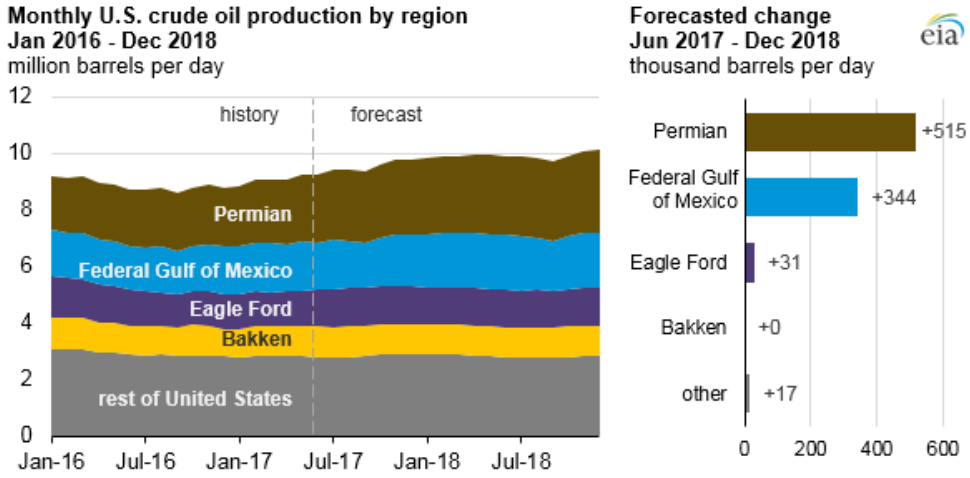
IEP Staff Writer

The U.S. Energy Information Administration (EIA) reported crude oil production for the United States in 2016 was 8,853 thousand barrels per day (b/d). This was 5.9% below 2015 production (9,408), but slightly higher (1.1%) than 2014 production (8,753). The majority of crude oil production (61.6%) was from the PADD3 area. PADD3 includes the majority of southern states (Alabama to Texas) and offshore production in the Gulf.

Texas far and away leads all state producers with 3,213 thousand b/d. The next closest state in production is North Dakota with 1,033, followed by California (508), and Alaska (490). The table below highlights the top eight (8) areas constituting 90.1% of U.S. crude oil production.

2016 U.S. Crude Oil Production (barrels/day x 10^3)	
Texas	3,213
Federal Offshore (Gulf)	1,598
North Dakota	1,033
California	508
Alaska	490
Oklahoma	420
New Mexico	399
Colorado	317

Forecasts for 2017 and beyond are for production to reach a record high in 2018. In the EIA's latest Short Term Energy Outlook, U.S. production is forecast to average 9,300 thousand b/d in 2017 and 9,900 thousand b/d in 2018. The projected 2018 production will surpass the previous production high of 9,600 b/d in 1970 by 3.1%. Most of the increased production is expected to come from tight rock formations within (Permian Basin) Texas/New Mexico and the Federal Offshore Gulf of Mexico.



Source: U.S. Energy Information Administration

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