

Nuclear Power in Ukraine's Energy Mix

by

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Nuclear Energy in Ukraine and the World

- Stable and economical supply of electrical energy is essential to the economic growth for *any* country.
- Commercial nuclear energy, born some 60 years ago, grew rapidly in the 60s and 70s, and then fell on hard times in the 80s after Three Mile Island (1979) and Chernobyl (1986).
- Nuclear energy is undergoing a worldwide renaissance in the wake of growing concerns about global warming.
- Solar energy will play a limited role in Ukraine due to its northern latitude.
- Nuclear plants being offered by the industry are significantly more safe and damage resistant.

Nuclear Energy in Ukraine and the World

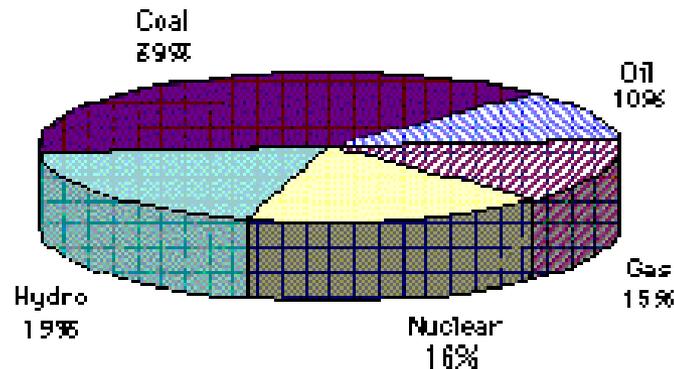
Nuclear Power Plants Around the World



Nuclear Energy in Ukraine and the World

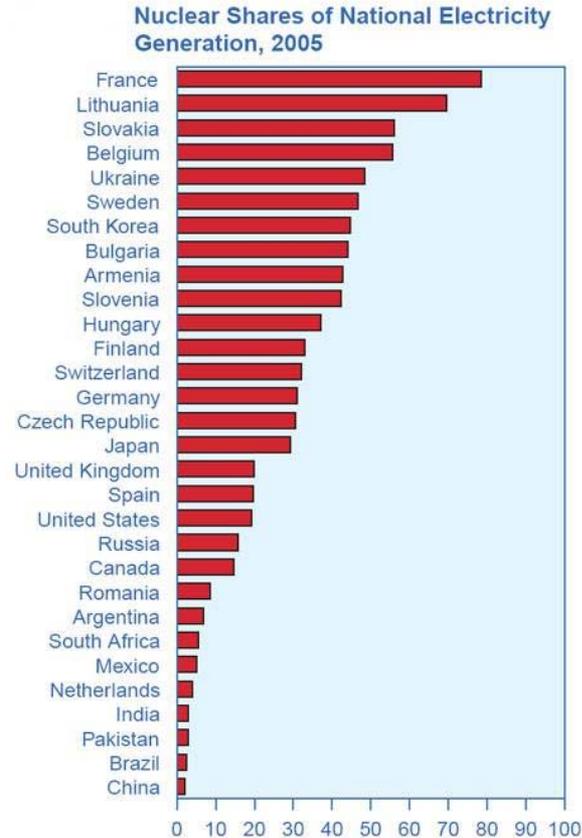
- There are now some 435 commercial nuclear power reactors operating in 30 countries, with 370,000 MW of total capacity.
- They supply 16% of the world's electricity.

World Electricity Generation

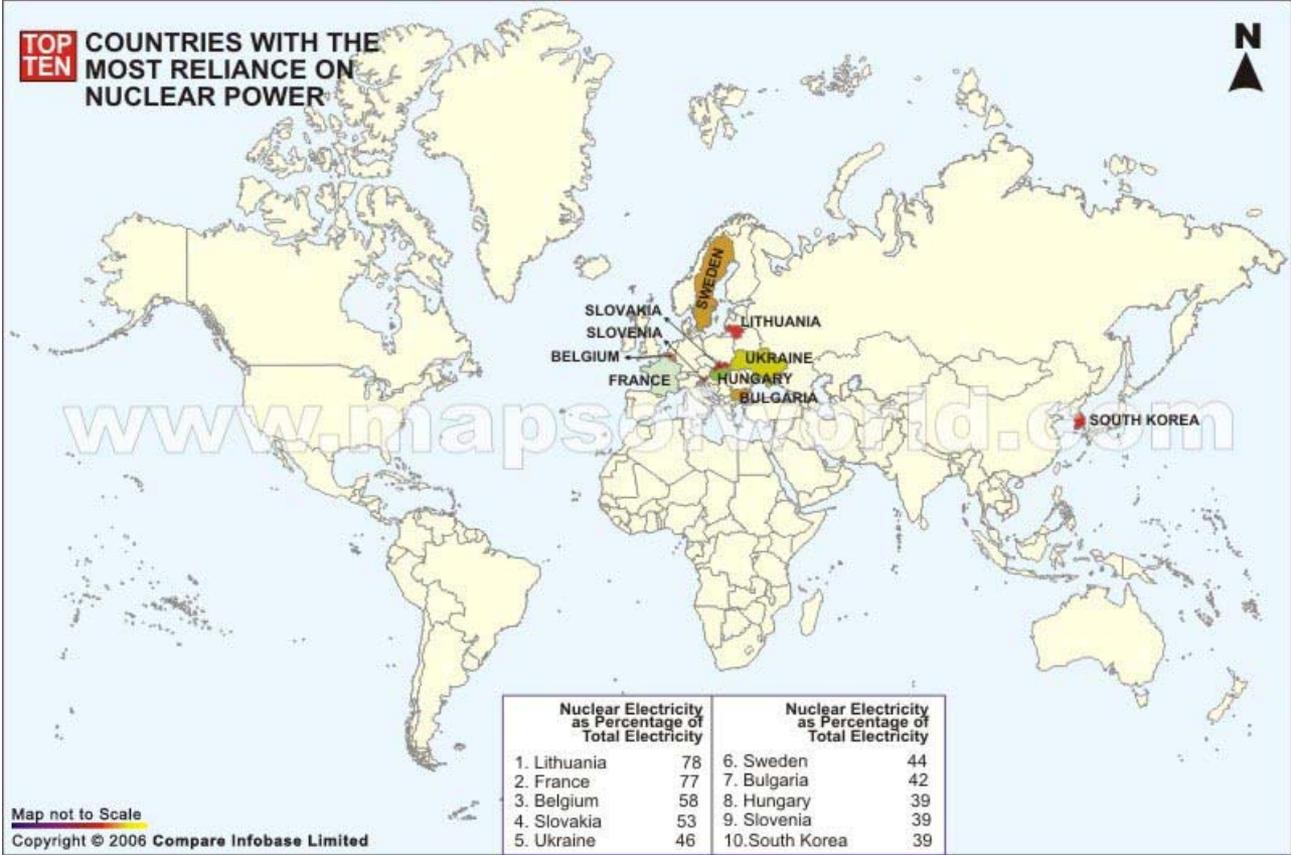


Nuclear Energy in Ukraine and the World

Nuclear Power Plants Around the World

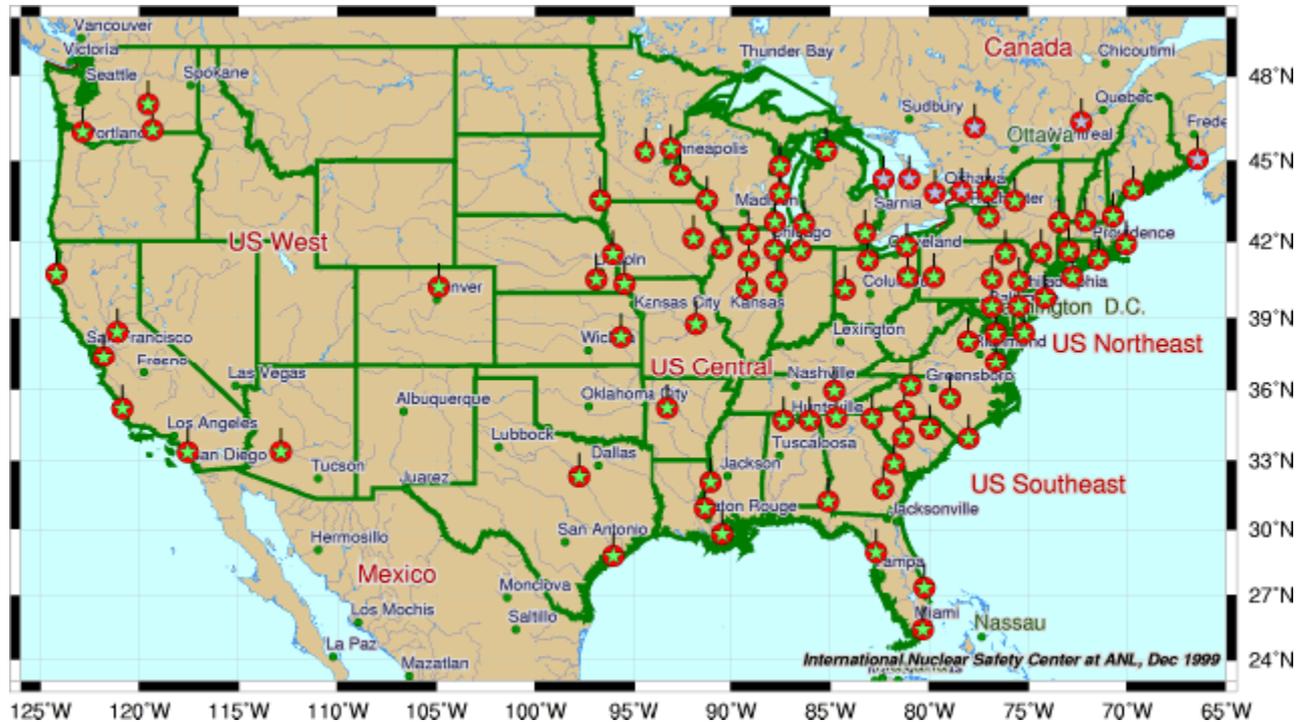


Nuclear Energy in Ukraine and the World



Nuclear Energy in Ukraine and the World

- The U.S. has 104 nuclear power plants which produce 20% of our electricity



Nuclear Energy in Ukraine and the World

- World wide nuclear power plant construction and planning:
 - 30 nuclear power reactors are currently being constructed in 11 countries (including France, Finland, China, South Korea, Japan and Russia).
 - 110 more planned
 - ✓ India's target is to add 20 to 30 new reactors by 2020
 - ✓ China plans a five-fold increase in nuclear capacity to 40 GW by 2020
 - ✓ Russia - two plants per year from 2011 to 2014 and then three per year until 2020
 - Other nuclear countries planning to build more plants
 - ✓ U.K. has given green light to new nuclear power plants

Nuclear Energy in Ukraine and the World

- Drivers for nuclear energy growth include:

- Need for power



- Climate change concerns



- Uncertain costs of clean coal



- Oil/gas price volatility



- Nuclear environment costs

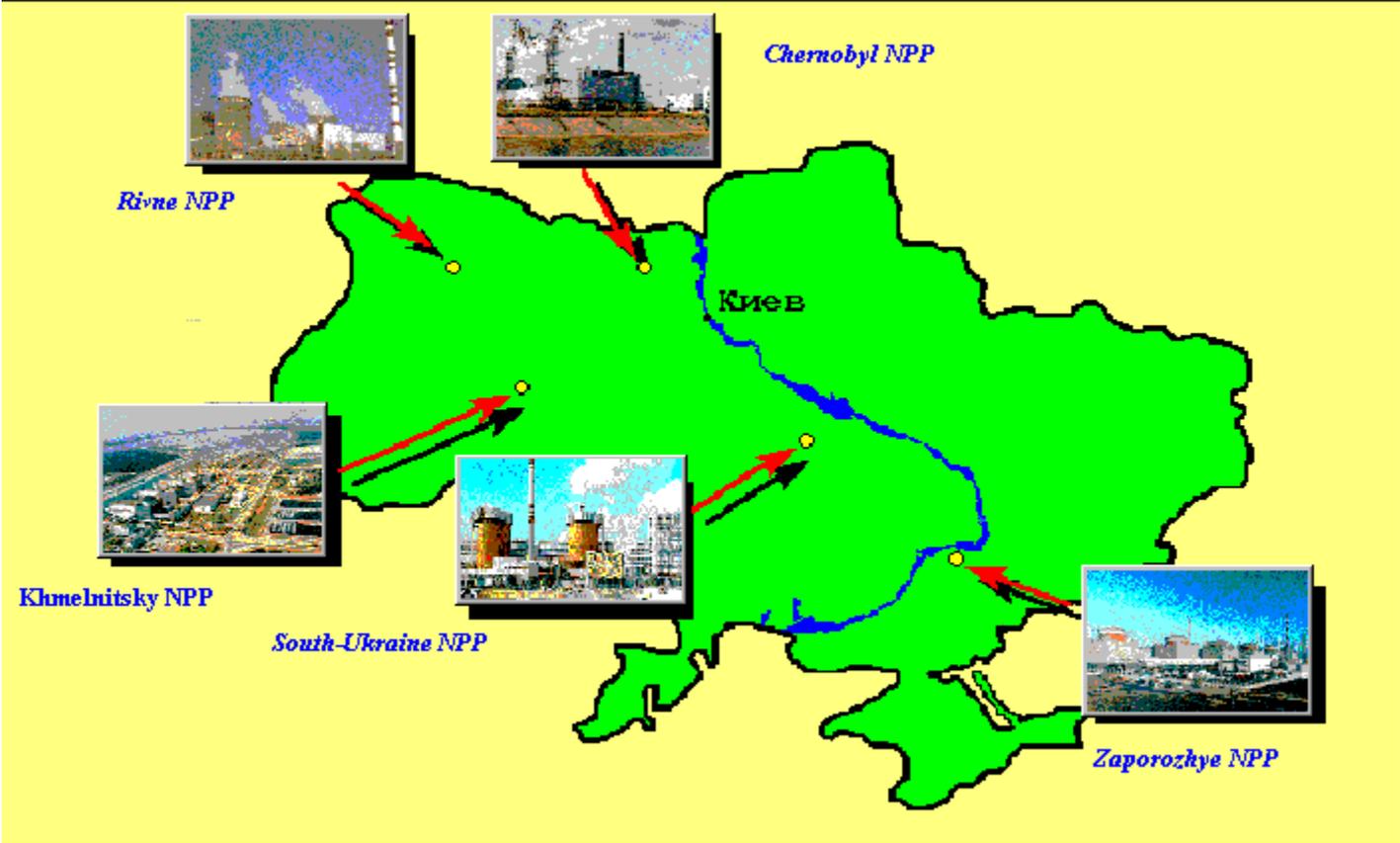


Nuclear Energy in Ukraine and the World

- Ukraine has Europe's fourth largest commercial nuclear program
- 15 Operating reactors provide more than half of Ukraine's electric output
- The country plans to bring up to 20 GW(t) on-line by year 2030

Nuclear Energy in Ukraine and the World

Ukrainian NPP



Obstacles to the Increase in Installed Nuclear Capacity in a Country

I. High Cost

- Original new plant estimates
 - \$1,500 to \$2,000 per kilowatt of capacity
 - 2007 estimates vary widely from \$2950/kWe to a Moody's Investors Service conservative estimate of between \$5000 and \$6000/kWe
- Skyrocketing cost of materials
 - Since 2003:
 - ✓ Steel prices have risen over 100%
 - ✓ Copper prices nearly quadrupled
 - ✓ Cement prices up 40%
- Recent report states that cost of building new power plants in North America have soared over 30 percent over the last year

Obstacles to the Increase in Installed Nuclear Capacity in a Country

II: Nuclear Waste

- Low-Level Waste
 - nuclear waste that is not high-level waste, spent nuclear fuel, transuranic waste, or byproduct materials
- High-Level Waste
 - liquid waste generated from reprocessing spent nuclear fuel, research reactor and production reactor fuels, irradiated targets, and naval propulsion fuel.
- Spent Nuclear Fuel
 - spent nuclear fuel assemblies produced from nuclear reactors
- Transuranic Waste
 - waste were generated by nuclear weapons production and reprocessing of spent nuclear fuels

High Level Waste and Spent Nuclear Fuel Are Most Problematic

Holtec's Mission in Ukraine is to Provide Safe and Economical Solutions to the High Level Waste and Spent Nuclear Fuel Management Issues

A Synoptic Overview of Holtec International

- Holtec is a U.S. energy technology company with over 80% of its business in the commercial nuclear sector, and 20% in the fossil power plant sector
- Four Operating Divisions
 - Power Plant Components Division
 - Manufacturing Division
 - Nuclear Power Division
 - Air Cooled Systems Division



A Synoptic Overview of Holtec International Power Plant Components Division

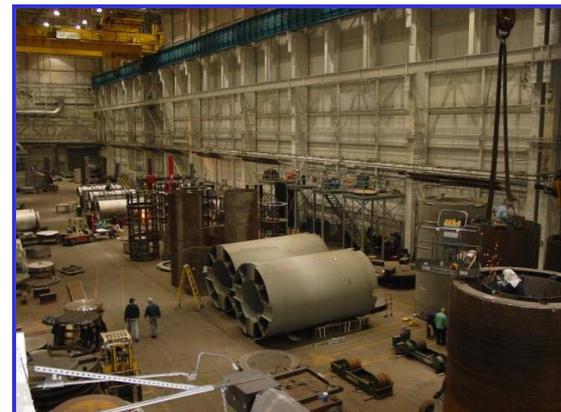
Holtec's Power Plant Components Division (PPCD) is one of the largest U.S. suppliers of heat transfer equipment to nuclear, coal and combined cycle plants.

- Over 120 cogeneration plants around the world feature PPCD-supplied main steam condensers and heat exchangers.
- PPCD is one of only three active world suppliers of air cooled condensers.
- PPCD is one of three active U.S. suppliers of feedwater heaters for power plants.



A Synoptic Overview of Holtec International Holtec Manufacturing Division

- Holtec Manufacturing Division (HMD) was formerly UST&D, Inc. Located in Pittsburgh, Pennsylvania, acquired by Holtec International in January 2004.
 - HMD holds all ASME Code stamps actively used in the industry (nuclear and non-nuclear).
 - Factory workspace is over 340,000 sq. ft. (one of the largest in the U.S.)
 - 200-ton overhead crane lifting capacity



A Synoptic Overview of Holtec International Nuclear Power Division

- Turnkey design, manufacturing and installation of high density spent fuel racks was the principal mainstay of Holtec's nuclear business in the 80s and early 90s.
- Over 80 nuclear plants on four continents reracked with Holtec's wet storage technology.
- Over 45 plants worldwide are under contract for use of Holtec's dry storage systems.



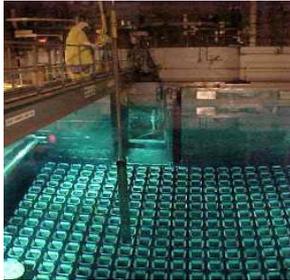
Air Cooled Systems Division

- Provides means to operate power plants in parched regions of the world where water (needed to run traditional power plants) is scarce.

A Synoptic Overview of Holtec International

Broad Product Portfolio

Wet Storage



Dry Storage



Heat Exchangers



Feed Water Heaters



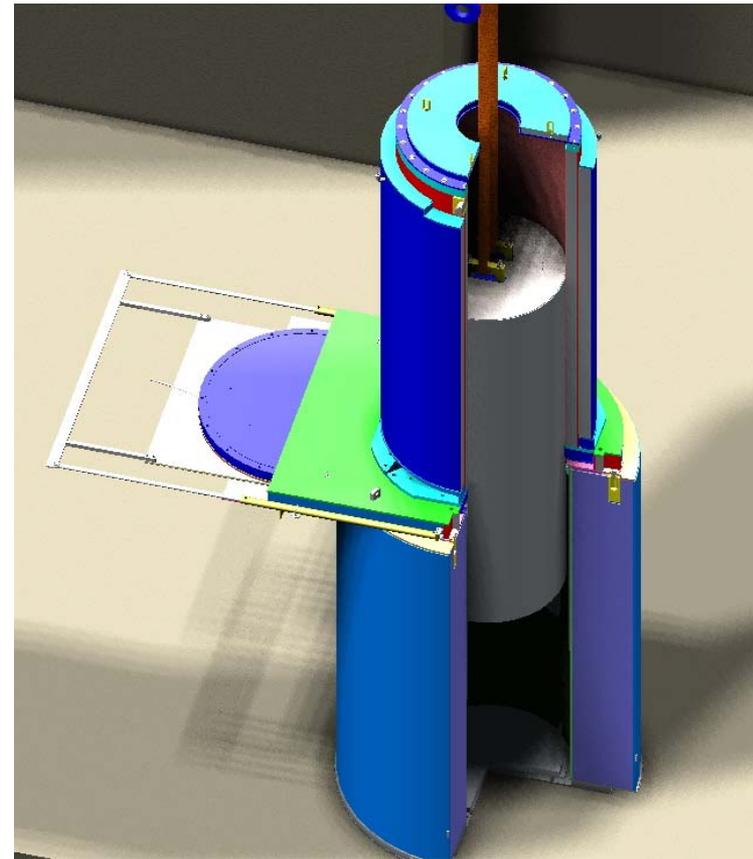
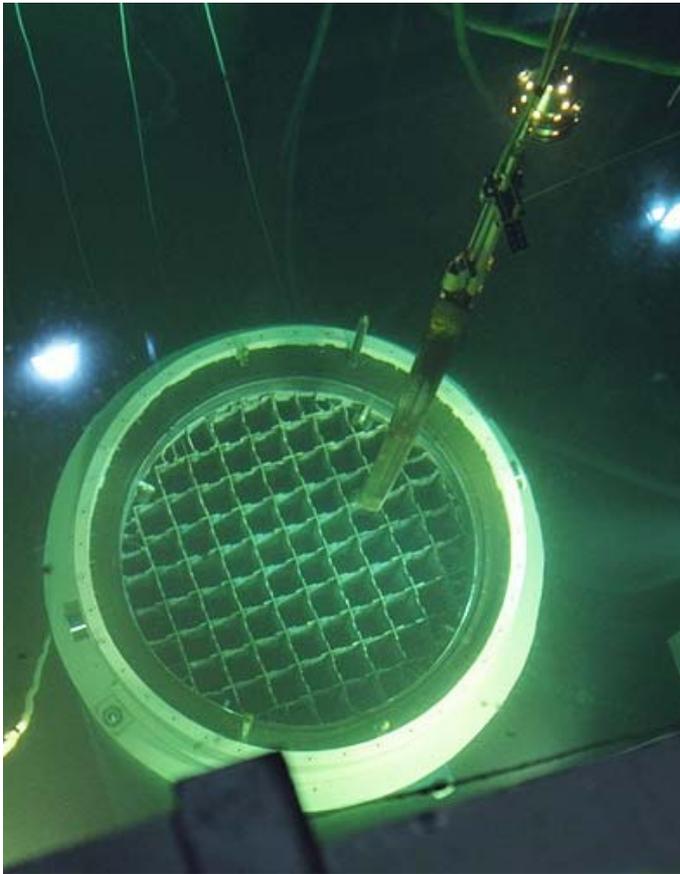
Condensers



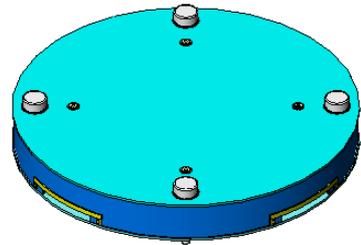
**Site Services
and Construction**



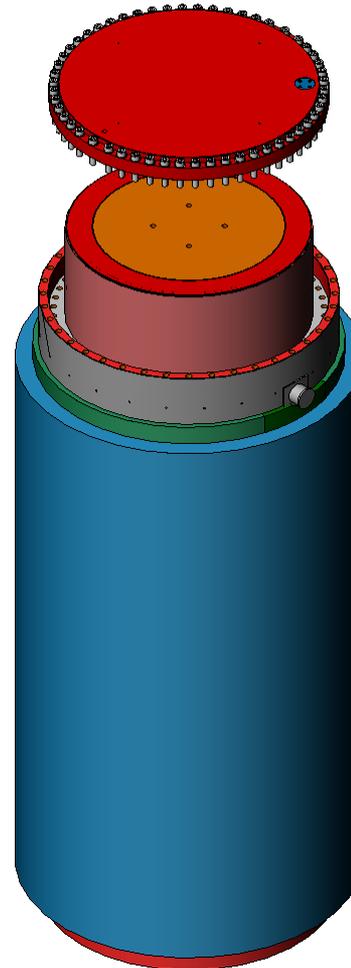
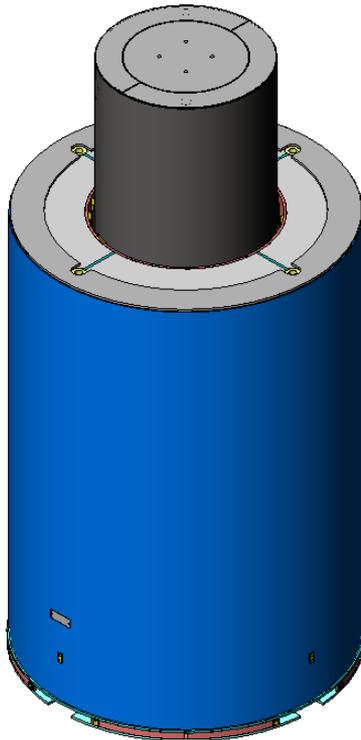
A Synoptic Overview of Holtec International Spent Nuclear Fuel Storage is a Core Holtec Expertise



A Synoptic Overview of Holtec International Holtec Spent Fuel Storage Technology Is Used at Over 80 Nuclear Plants Around the World



HI-STORM
For Storage



HI-STAR
For Transport

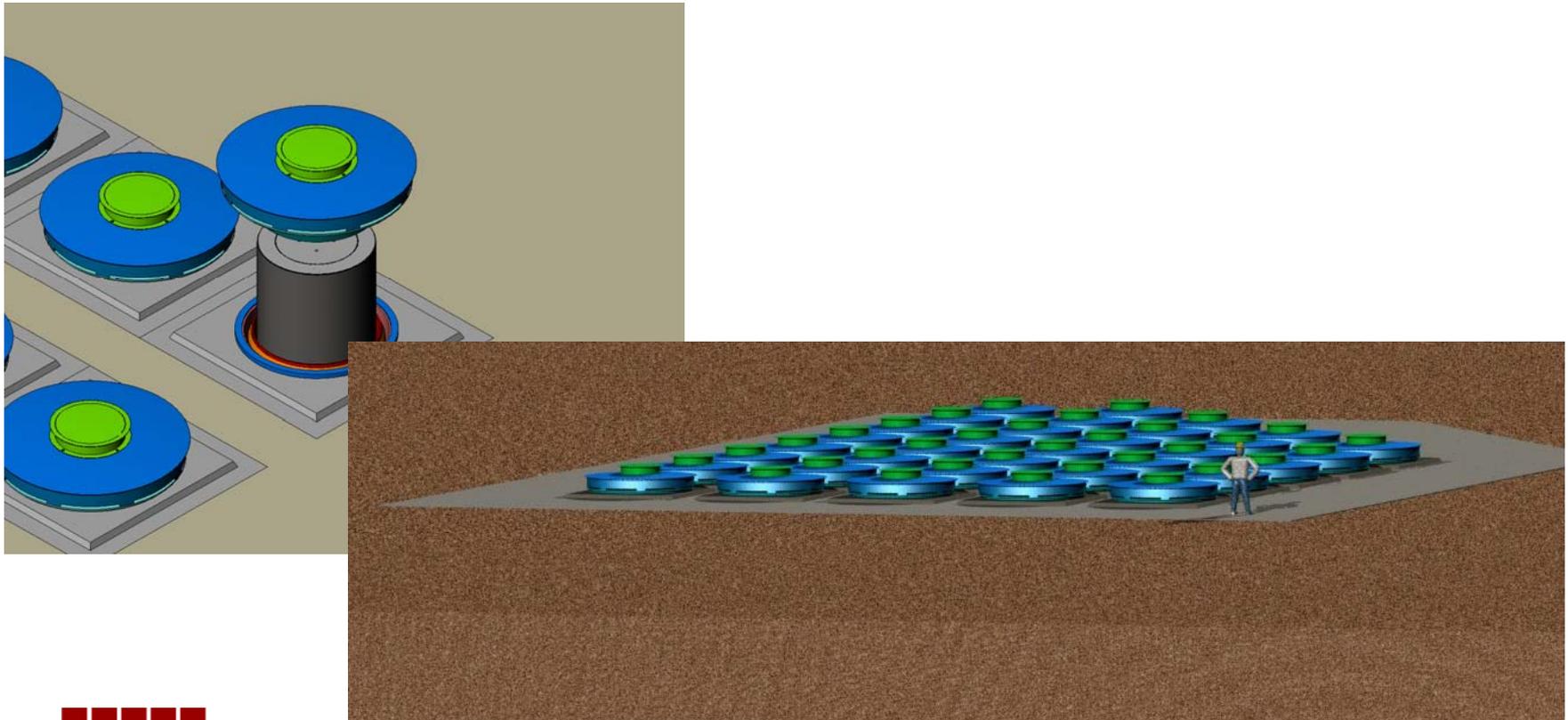
A Synoptic Overview of Holtec International

A Typical Spent Fuel Storage Facility



A Synoptic Overview of Holtec International

Underground Storage System (Latest Holtec Technology to Make Fuel Storage Safe from Terror)



Holtec's Strategy for Ukraine

A nuclear power plant requires a large investment in capital and labor:

Equipment & Commodities for First Eight Plants (Examples)

- Cable – over 1800 miles
- Nuclear grade valves – over 11,000
- Pumps – 1400 to 2200
- Nuclear grade piping – 30 – 150 miles
- Concrete – over 3 million cubic yards
- Electrical components – over 700,000
- Structural & reinforcing steel – 500,000 tons approx.
- Large and small heat exchangers – 500 to 1300
- Fasteners – 320,000

Holtec's Strategy for Ukraine

To Manage its Nuclear Sector's Growth,
Ukraine must:

- Attract foreign capital
- Build on its existing design manufacturing and services infrastructure
- Develop domestic capacity to manage its fuel cycle

Holtec's Strategy for Ukraine

Holtec's Vision: Become a Trusted Partner in Ukraine's Progress by:

- Investing capital in the Country's nuclear infrastructure
- Develop domestic manufacturing capacity to produce nuclear component to world-class quality assurance requirements
- Open a regional technology center in Ukraine to develop local technical talent to serve the national's nuclear industry
- Collaborate with Energoatom and other national institutions to develop the Country's nuclear services sector

Holtec's Strategy for Ukraine

Realizing the Vision

- **Holtec** is investing over \$150 million to design, license & build Ukraine's first Central Storage Facility to store used nuclear fuel
- **Holtec** is actively searching for a manufacturer to localize manufacturing of Holtec's engineered systems & components
- **Holtec** has opened a technology center in Kyiv to provide design & licensing services to the domestic and foreign nuclear plants
- **Holtec** intends to cooperate with Energoatom to participate in fuel management services for the country's nuclear plants

Acknowledgement

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