Power Plant Infrastructure in Ukraine: A Vulcan IW Analysis – Satellite Truths on Infrastructure

Based on the latest updates (2024) from https://globalenergymonitor.org/, Ukraine currently has:

- 9 operational gas plants (total capacity:2.8 GW) with 21 units
- 9 operational coal plants (total capacity: 5.4 GW) with 34 units
- 4 operational nuclear plants (total capacity: 13.8 GW) with 15 units
- 8 operational hydro plants (total capacity: 6.2 GW) with 10 units
- 7 mothball gas plants (total capacity: 5.7 GW) with 18 units
- 13 mothball coal plants (total capacity: 16.1 GW) with 67 units
- 1 mothball hydro plant (total capacity: 0.3 GW) with 1 unit

We utilized Vulcan IW (Infrastructure Watch), a feature available to Vulcan clients, to visualize these plants via satellite images. As the name suggests, Vulcan IW allows monitoring and visualization of existing infrastructure before and after key events.

We are committed to a crowdsourced approach and welcome client input on key areas of focus. In this report, we aimed to determine if Russia targeted critical power plants in Ukraine, as disrupting infrastructure is a common war strategy designed to cripple an enemy's ability to function.

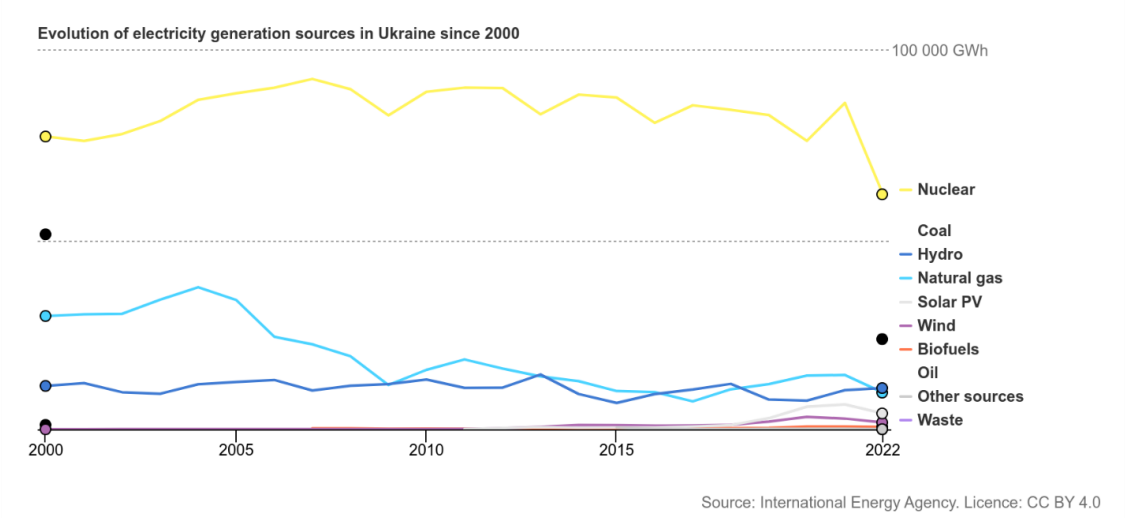
Our analysis using Vulcan IW shows that **all operational power plants appear visually intact**. In addition, even the mothball plants seem to have minimal visual damage other than 2 plants (Kakhovka-1 hydroelectric plant & Zmiivska power station). For 6 of the mothball plants our recent satellite photos show steam from the plant indicating operations. This finding has significant implications for the future supply and demand of coal and gas in Ukraine, as well as the extent of restorative efforts required by the Ukrainian government after the war.

Examining Ukraine's Power Consumption Trends

This section analyzes Ukraine's electricity consumption data retrieved from the International Energy Agency (IEA) website (https://www.iea.org/countries/ukraine/electricity).

- **Peak Electricity Usage:** Ukraine's peak electrical usage occurred in 2012, reaching 198,878 GWh.

- **Declining Consumption:** Since 2012, there has been a consistent decline in electricity consumption.
- **2021 Consumption:** Pre-war data for 2021 indicates a total consumption of 157,910 GWh, which remains 20% lower than the 2012 peak.



In 2021 nuclear represented 55% of the total generation – therefore plays the most crucial generation piece for Ukraine – followed by coal at 23%. The rest of the fuel categories represent less than 10% each.

Economic Implications of Declining Consumption

A declining trend in energy consumption is often seen as an indicator of a sluggish economy. Since economic activity is heavily reliant on energy use, this decrease is concerning given this was seen before the war.

Operational Capacity Meets 2021 Demand

Our analysis of operational power plants using Vulcan IW suggests that their combined capacity can potentially fulfill Ukraine's 2021 energy demand, assuming a 65% capacity factor for the fleet.

The Global Energy Monitoring notes many Ukraine plants as mothball. From the description of these mothball plants, they are typically the ones damaged from attacks. Our satellite examination of these mothballs shows some conflicting results with the conclusions noted by GEM who document articles they used as references. Out of the 21 mothball plants we show only 2 with visual physical damage. Supporting the power issues in Ukraine are not likely from power plants.

Potential Causes of Power Issues

Despite sufficient operational capacity, Ukraine has experienced power disruptions. This suggests that the cause of these issues may lie elsewhere, potentially in:

- **Fuel Shortages:** Lack of adequate fuel supplies for power plants could be hindering generation.
- **Transmission/Distribution Issues:** Damage or disruptions within the transmission and distribution infrastructure could be impeding electricity delivery to consumers.

Focus on Transmission and Distribution

Given the apparent functionality of operational power plants, restoration efforts may benefit from prioritizing the assessment and repair of transmission and distribution infrastructure. This could be a faster and more manageable approach compared to rebuilding power plants.

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Ukraine Power Monitoring

Operating Plants	
Balaklava power station	No Visible Damage
Bilotserkivska CHP power station	No Visible Damage
Cherkasy power station	No Visible Damage
Chernihiv power station	No Visible Damage
Darnytska power station	No Visible Damage
Kalush power station	No Visible Damage
Khmelnitski nuclear power plant	No Visible Damage
Kramatorskaya power station	No Visible Damage
Kyiv CHP-5 power station	No Visible Damage
Kyiv CHP-6 power station	No Visible Damage
Rivne nuclear power plant	No Visible Damage
Saki power station	No Visible Damage
Shostkinska power station	No Visible Damage
Simferopol CHP power station	No Visible Damage
South Ukraine nuclear power plant	No Visible Damage
Starobesheve power station	No Visible Damage
Tavri power station	No Visible Damage
Zaporizhzhia nuclear power plant	No Visible Damage
Zuevskaya power station	No Visible Damage
Mothballed Plants	
Burshtyn power station	No Visible Damage
Dobrotvir power station	No Visible Damage
Kakhovka-1 hydroelectric plant	Damaged
Kharkiv CHP-5 power station	No Visible Damage
Kremenchuk CHP power station	No Visible Damage
Kryvorizka power station	No Visible Damage
Kurakhov power station	No Visible Damage
Ladyzhyn power station	No Visible Damage
Luganskaya power station	No Visible Damage
Myronivskyi power station	No Visible Damage
Prydniprovska power station	No Visible Damage
Severodonetsk CHP power station	No Visible Damage
Slavyansk power station	No Visible Damage
Trypilska power station	No Visible Damage
Vuglegirska power station	No Visible Damage
Zaporizhia power station	No Visible Damage
Zasyadko mines power station	No Visible Damage
Zmiivska power station	Damaged

Operating Plants

Balaklava power station, Natural Gas, 496 MW operating – Vulcan Status: No Visible Damage

7/24/2021

8/19/2024

11/23/2021

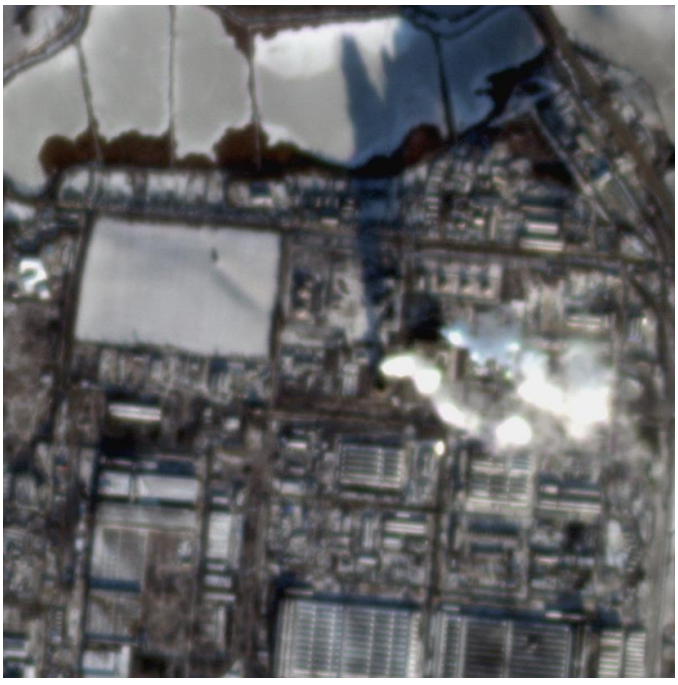
12/9/2024

Bilotserkivska CHP power station, Natural Gas, 120 MW operating – Vulcan Status: No Visible Damage

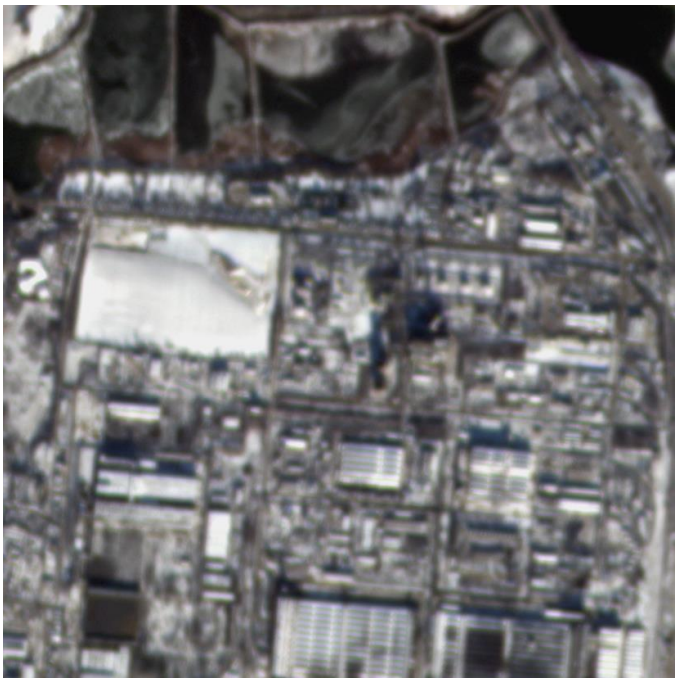
7/17/2021

8/24/2024

12/23/2021



12/14/2024



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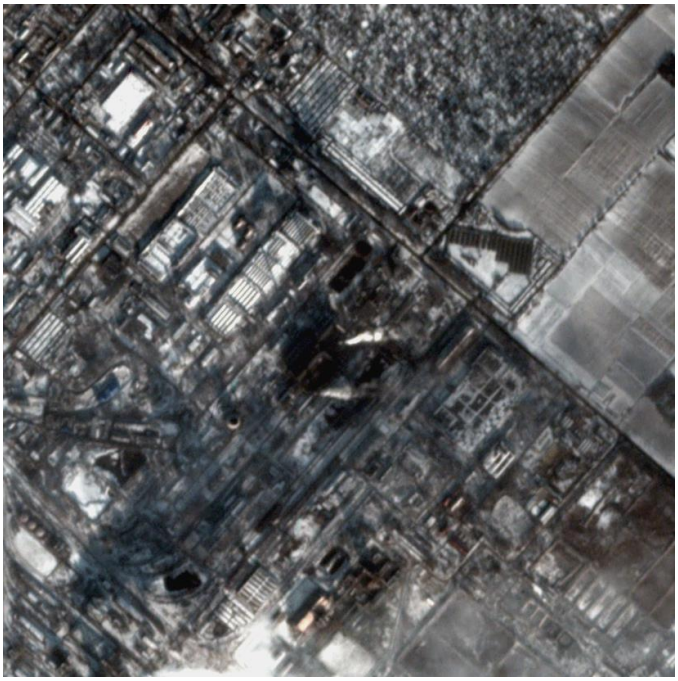
Cherkasy power station, Coal, 180 MW operating – Vulcan Status: No Visible Damage

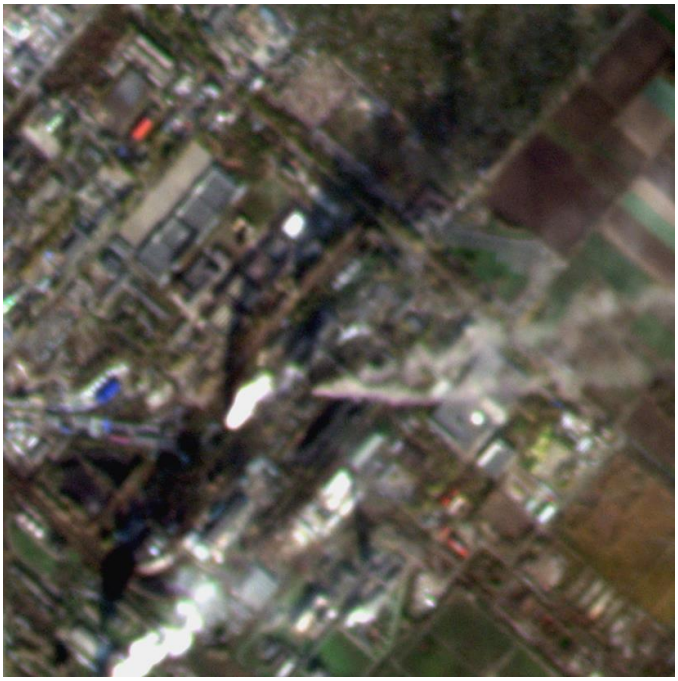
7/24/2021

8/24/2024

11/26/2021



11/18/2024

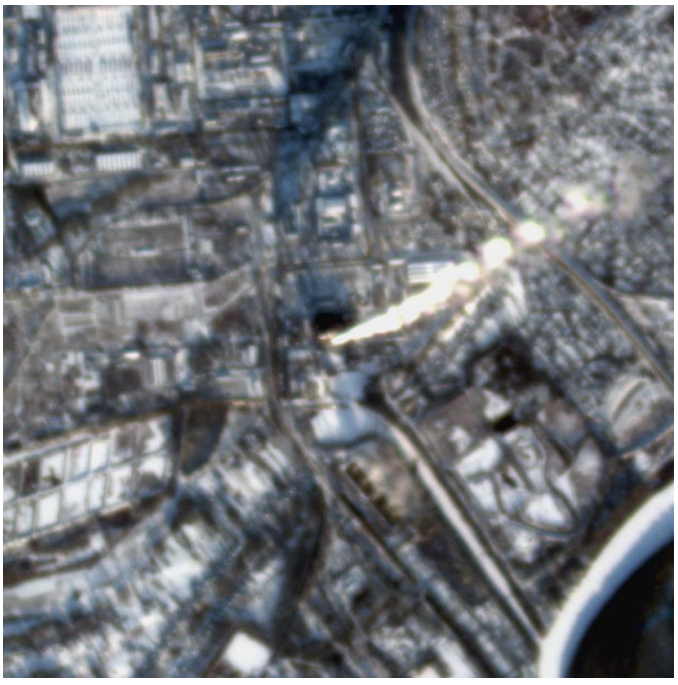


Chernihiv power station, Natural Gas, 220 MW operating – Vulcan Status: No Visible Damage

7/23/2021

8/24/2024

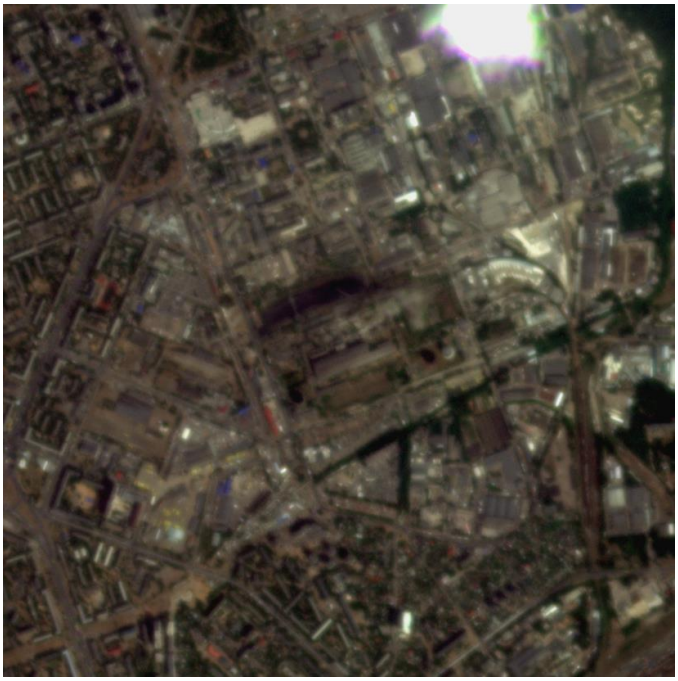
12/27/2021



11/17/2024

Darnytska power station, Coal, 160 MW operating – Vulcan Status: No Visible Damage

7/15/2021



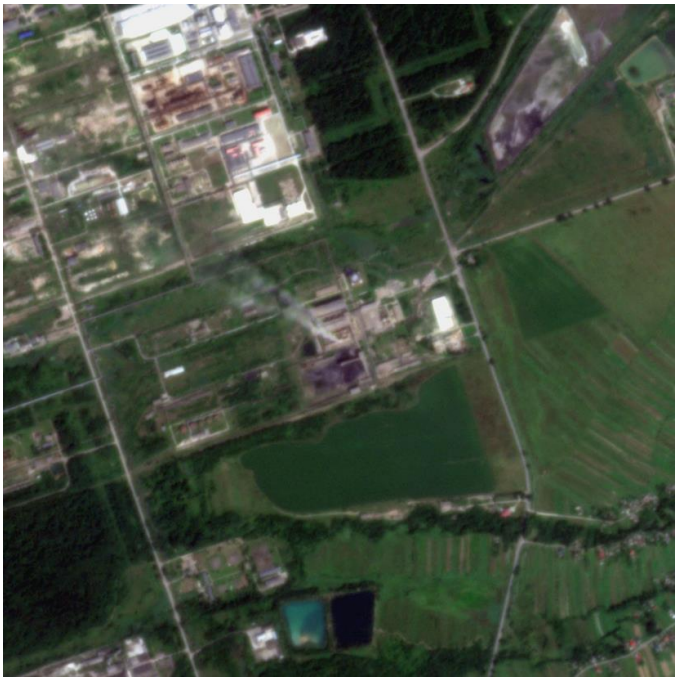
8/24/2024

12/4/2021

12/14/2024

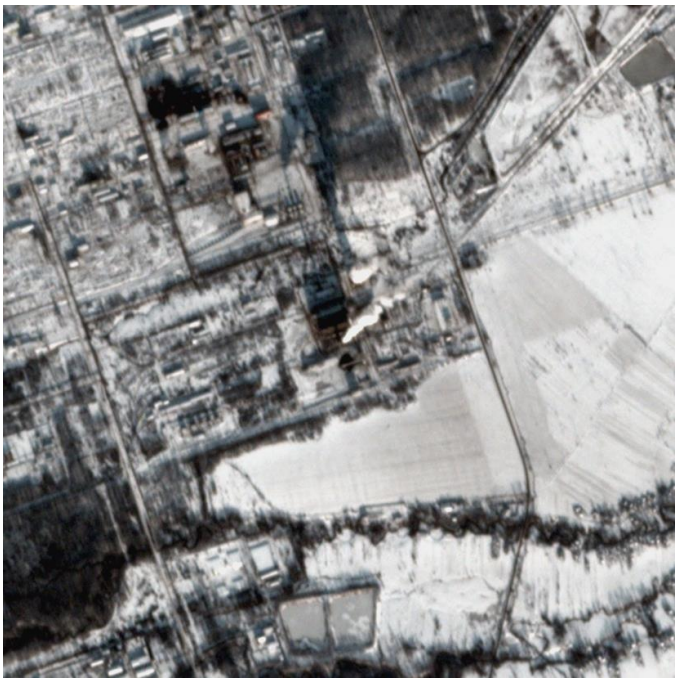
Kalush power station, Coal, 200 MW operating – Vulcan Status: No Visible Damage

7/24/2021

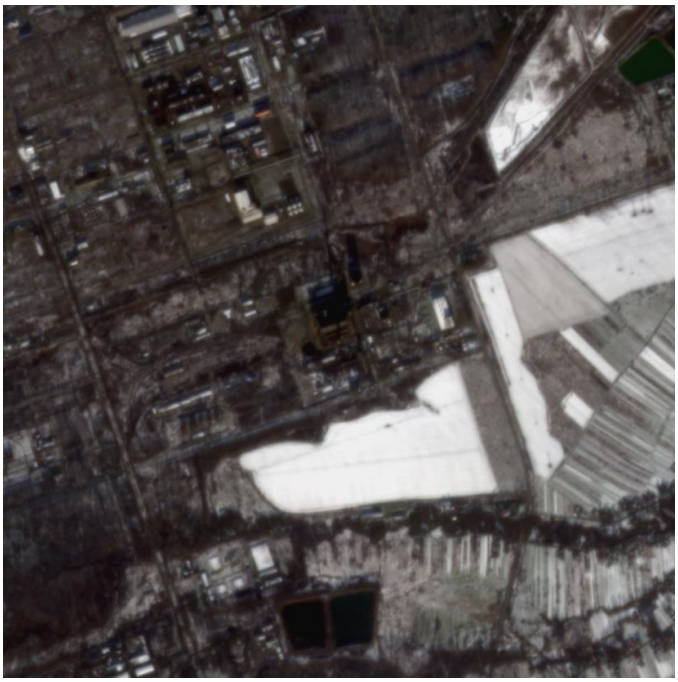


8/24/2024

11/23/2021



11/25/2024



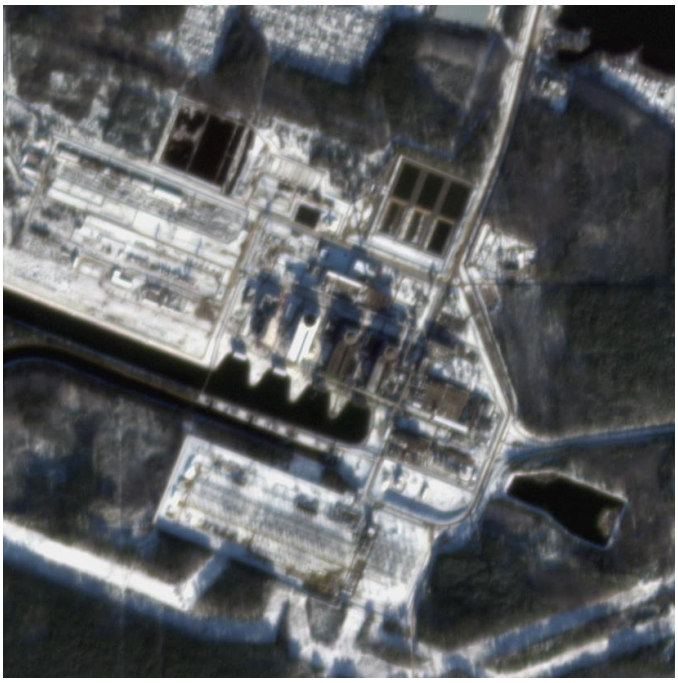
Khmelnitski nuclear power plant, Nuclear, 2000 MW operating – Vulcan Status: No Visible Damage

7/18/2021

8/24/2024

12/21/2021

12/14/2024



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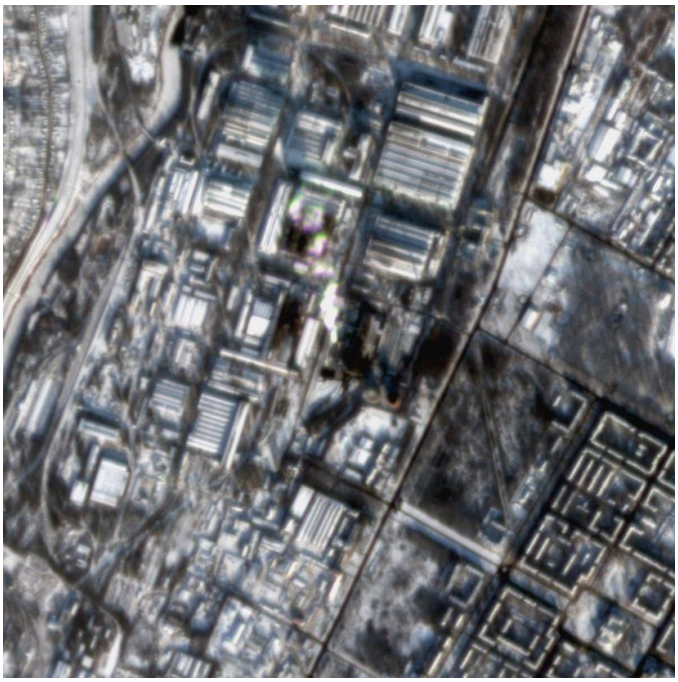
Kramatorskaya power station, Coal, 120 MW operating – Vulcan Status: No Visible Damage

7/20/2021

8/24/2024

12/24/2021



10/24/2024

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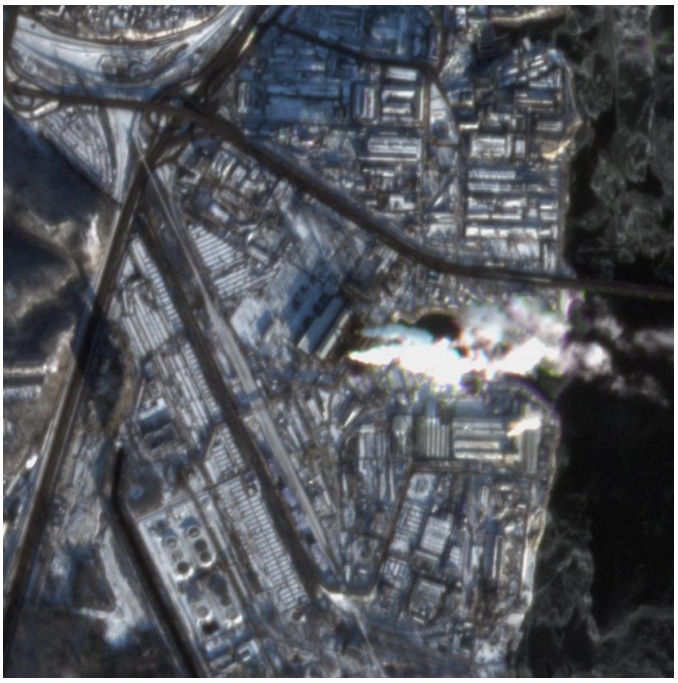
Kyiv CHP-5 power station, Natural Gas, 700 MW operating – Vulcan Status: No Visible Damage

7/15/2021

8/24/2024

12/26/2021



12/14/2024

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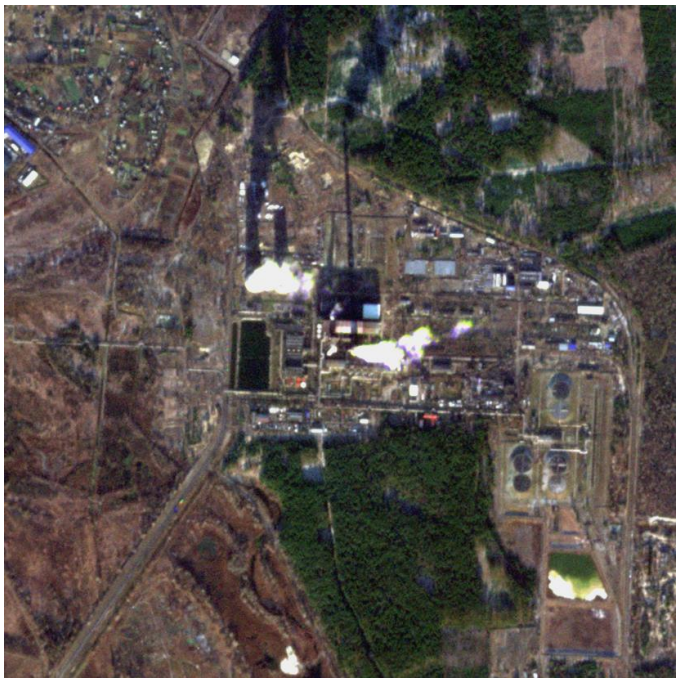
Kyiv CHP-6 power station, Natural Gas, 500 MW operating – Vulcan Status: No Visible Damage

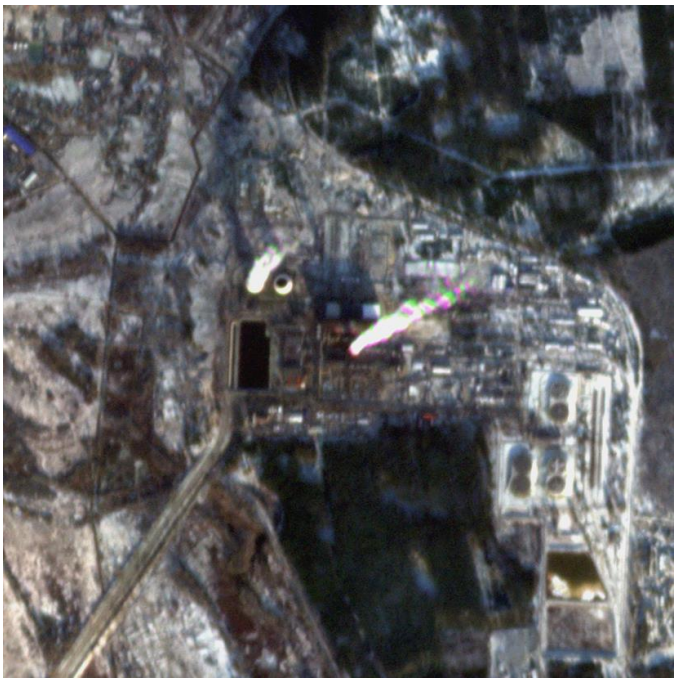
7/24/2021

8/24/2024

12/4/2021



12/14/2024



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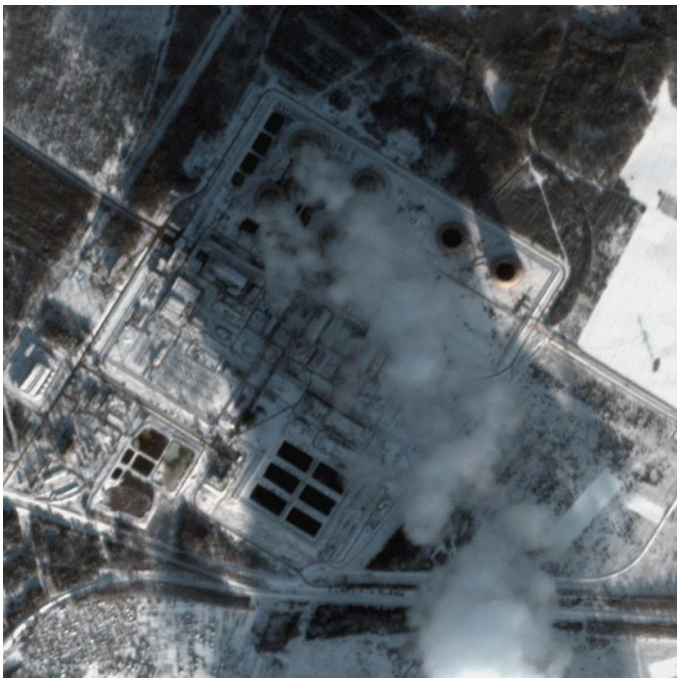
Rivne nuclear power plant, Nuclear, 2835 MW operating – Vulcan Status: No Visible Damage

7/16/2021

8/24/2024

12/21/2021



12/13/2024

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Saki power station, Natural Gas, 117.9 MW operating – Vulcan Status: No Visible Damage

7/24/2021

8/23/2024

12/10/2021

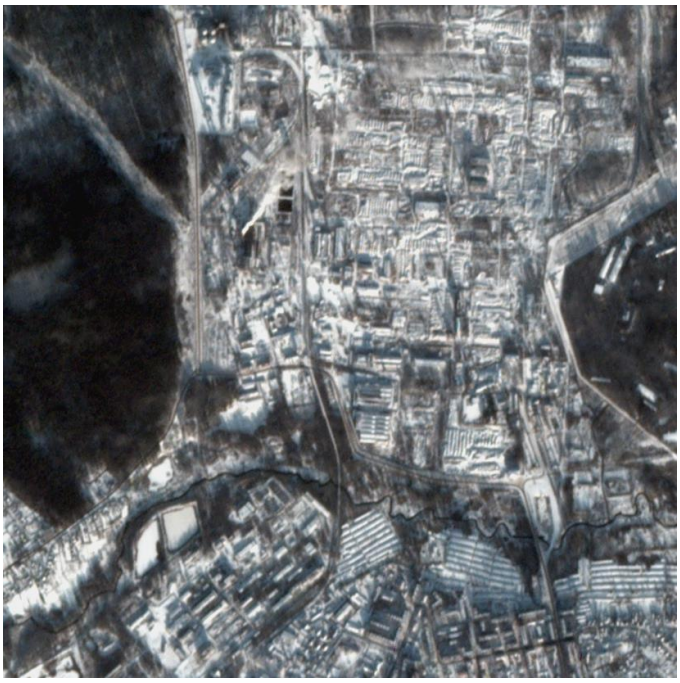
12/18/2024

Shostkinska power station, Natural Gas, 114 MW operating – Vulcan Status: No Visible Damage

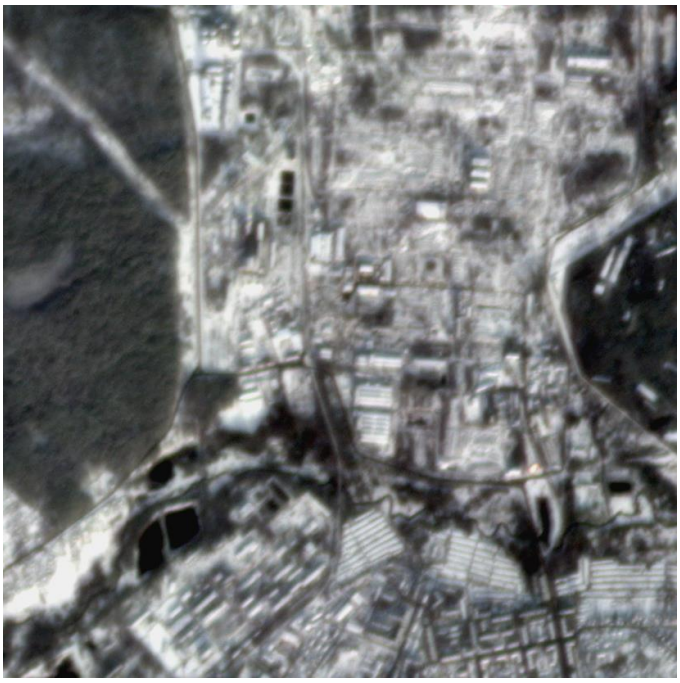
7/12/2021

8/21/2024

12/26/2021

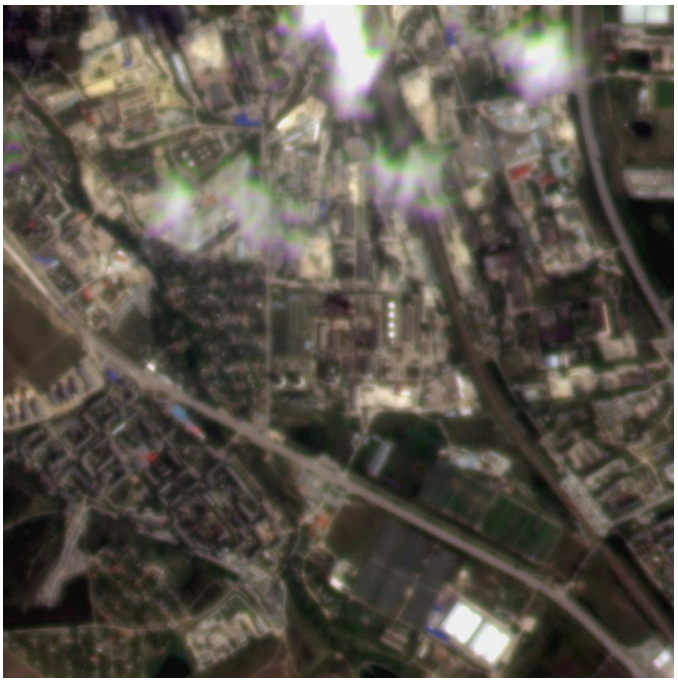


11/22/2024



Simferopol CHP power station, Natural Gas, 86 MW operating – Vulcan Status: No Visible Damage

7/19/2021



8/24/2024

12/23/2021

12/14/2024

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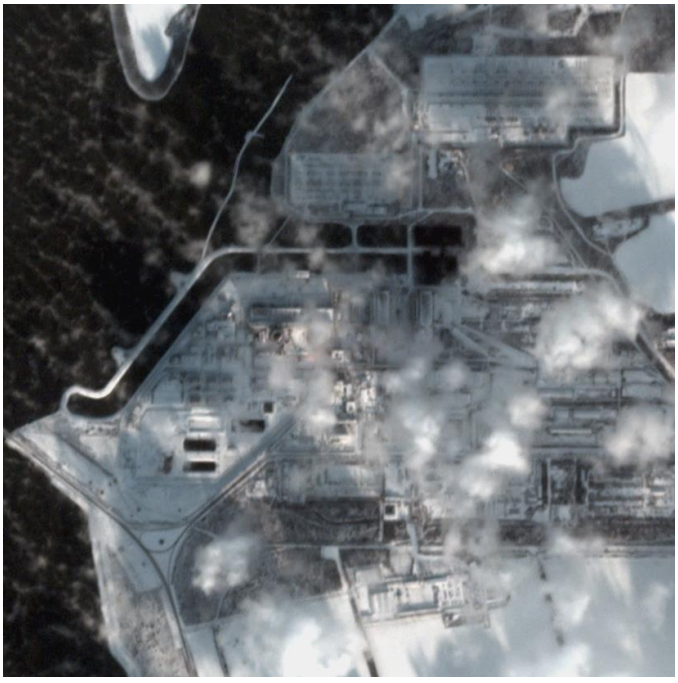
South Ukraine nuclear power plant, Nuclear, 3000 MW operating – Vulcan Status: No Visible Damage

7/22/2021

8/23/2024

12/22/2021



12/14/2024

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Starobesheve power station, Coal, 2010 MW operating – Vulcan Status: No Visible Damage

7/24/2021

8/24/2024

12/24/2021

12/14/2024

Tavri power station, Natural Gas, 490 MW operating – Vulcan Status: No Visible Damage

7/19/2021

8/24/2024

12/23/2021

12/14/2024

Zaporizhzhia nuclear power plant, Nuclear, 6000 MW operating – Vulcan Status: No Visible Damage

7/23/2021

8/24/2024

11/17/2021

11/19/2024

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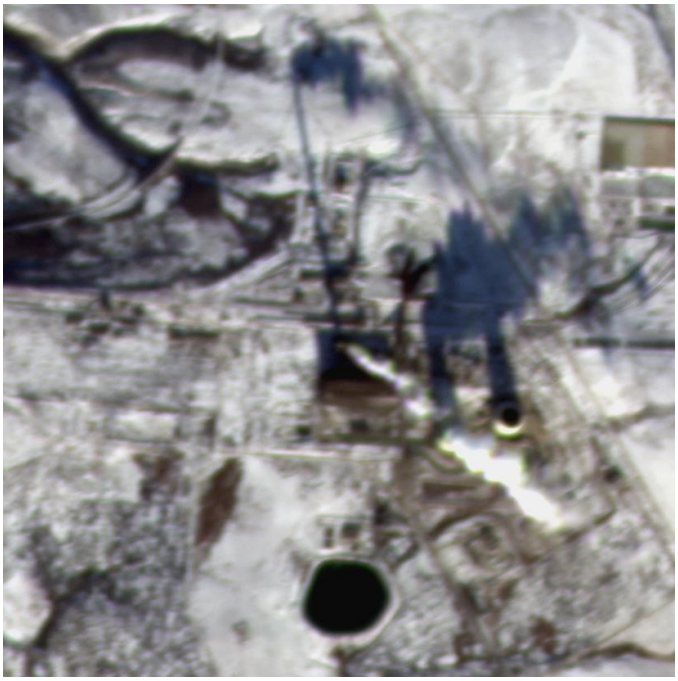
Zuevskaya power station, Coal, 1290 MW operating – Vulcan Status: No Visible Damage

7/19/2021

8/24/2024

12/24/2021

12/14/2024



Mothballed/ Non-Operational Plants

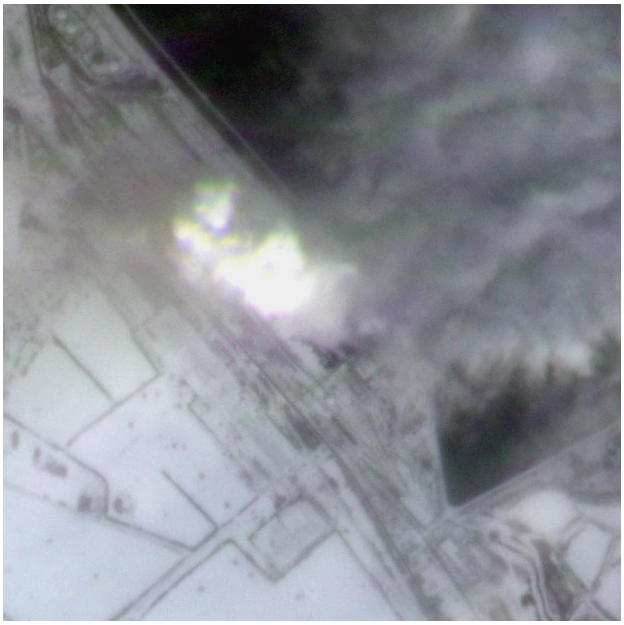
Burshtyn power station, Coal, 2366 MW mothballed – Vulcan Status: No Visible Damage

Plant appears operational 12/22/2024. Plant was subject to numerous attacks from 2022-2024. Reports in March 2024 state that all units disabled after an attack. https://www.gem.wiki/Burshtyn_power_station

7/28/2021

8/28/2024

12/26/2021



12/22/2024

Dobrotvir power station, Coal, 360 MW operating, 150 MW mothballed – Vulcan Status: No Visible Damage

Reports in 2023 and 2024 of damage from Russian attacks.
https://www.gem.wiki/Dobrotvir_power_station

7/18/2021

8/24/2024

11/26/2021

12/13/2024

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Kakhovka-1 hydroelectric plant, Hydroelectric, 355 MW mothballed – Vulcan Status: Damaged

Plant destroyed June 6, 2023 and mothballed. https://www.gem.wiki/Kakhovka-1_hydroelectric_plant

7/28/2021

8/25/2024 – Destroyed

11/25/2021

12/20/2024 - Destoyed

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Kharkiv CHP-5 power station, natural gas, 540 MW mothballed – Vulcan Status: No Visible Damage

Plant damaged in shelling 2023 and attacked again in March 2024.
https://www.gem.wiki/Kharkiv_CHP-5_power_station

7/30/2021

8/29/2024

12/27/2021

10/28/2024

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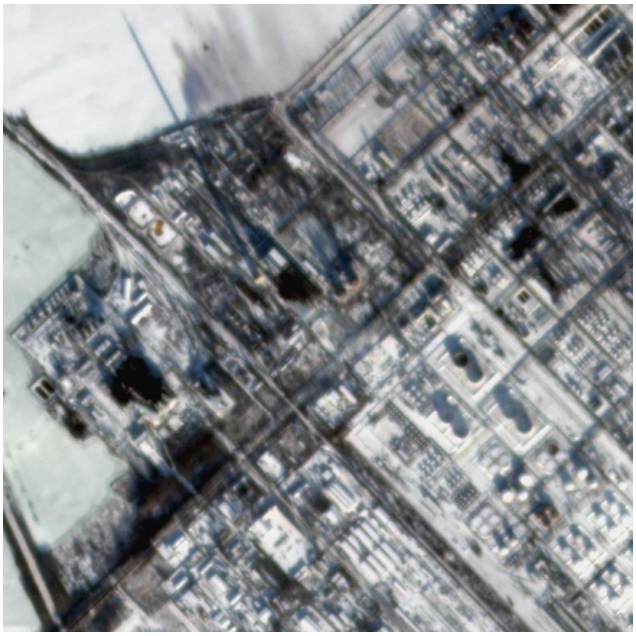
Kremenchuk CHP power station, Natural Gas, 255 MW mothballed – Vulcan Status: No Visible Damage

Plant appears operational 11/18/2024. Plant damaged in March and May of 2024 during Russian missile attacks. https://www.gem.wiki/Kremenchuk_CHP_power_station

7/27/2021

8/25/2024

12/26/2021



11/18/2024

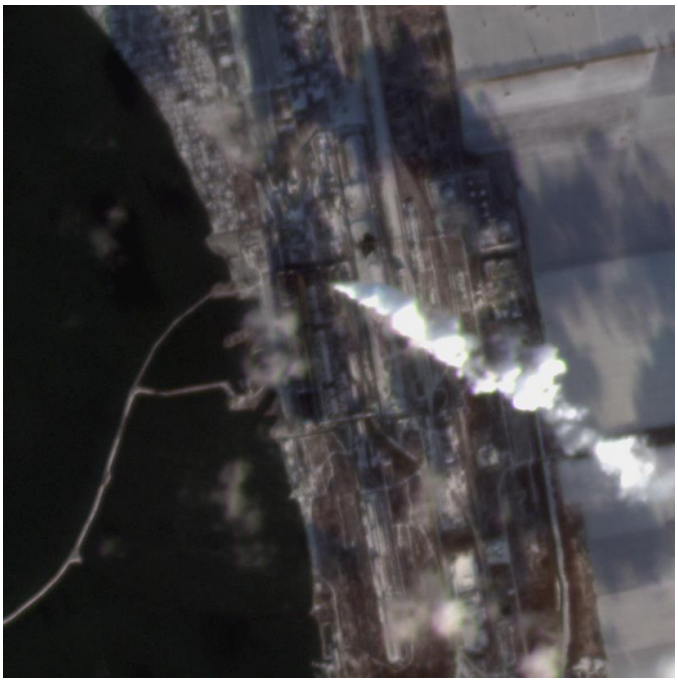
Kryvorizka power station, Coal, 282 MW operating, 1797 MW mothballed – Vulcan Status: No Visible Damage

Plant appears operational 12/14/2024. Plant was damaged during Russian attacks in April 2022. https://www.gem.wiki/Kryvorizka_power_station

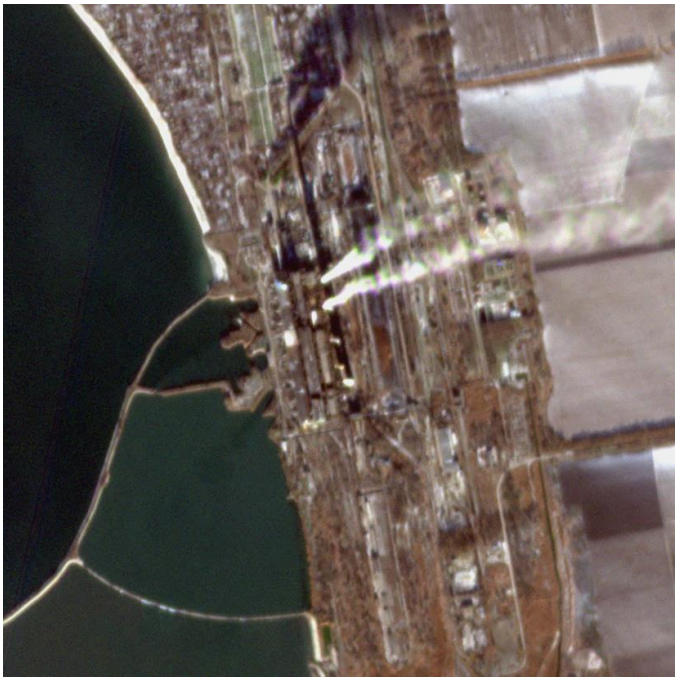
7/23/2021

8/24/2024

11/22/2021



12/14/2024



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Kurakhov power station, Coal, 1532 MW mothballed – Vulcan Status: No Visible Damage

No exterior damage visible, this plant is no longer in operation due to numerous attacks 2022-2023. https://www.gem.wiki/Kurakhov_power_station

7/28/2021

8/29/2024

12/27/2021

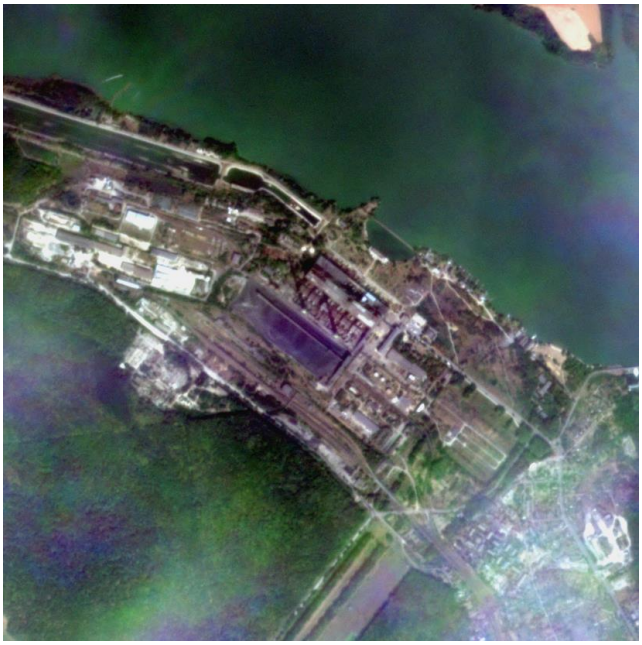
12/18/2024

Ladyzhyn power station, Coal, 1800 MW mothballed – Vulcan Status: No Visible Damage

Attacks in 2022-2024 have left the plant with all units completely or partially damaged.
https://www.gem.wiki/Ladyzhyn_power_station

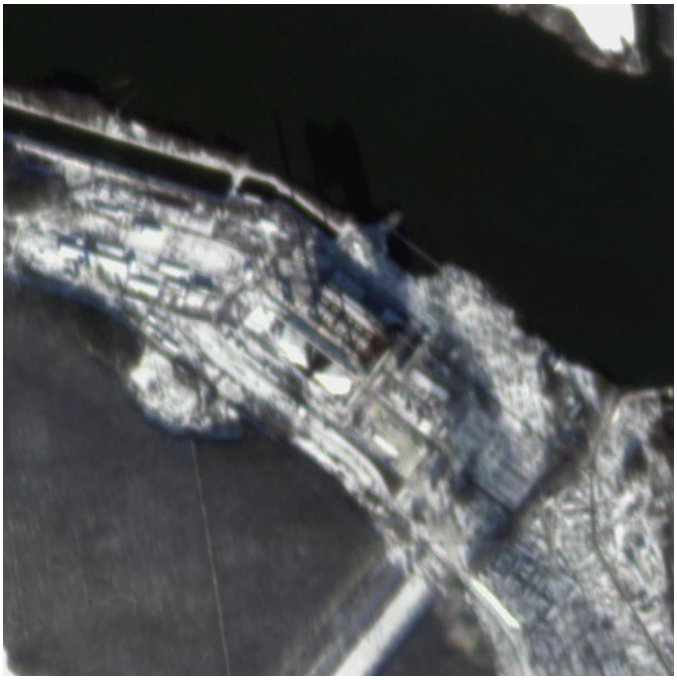
7/29/2021

8/30/2024



12/27/2021

12/13/2024



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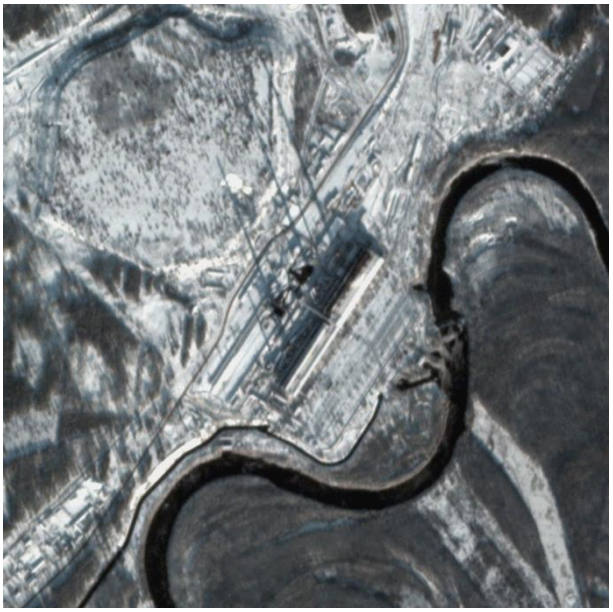
Luganskaya power station, Coal, 820 MW operating, 400 MW mothballed – Vulcan Status: No Visible Damage

Plant appears operational 12/14/2024. Plant was mothballed in 2022 following Russian attacks but is reported as partially restored as of late 2023.
https://www.gem.wiki/Luganskaya_power_station

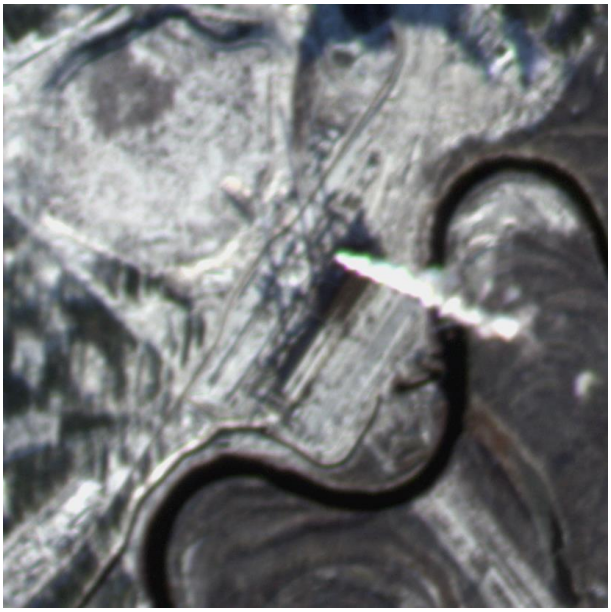
7/21/2021

8/24/2024

12/24/2021



12/14/2024



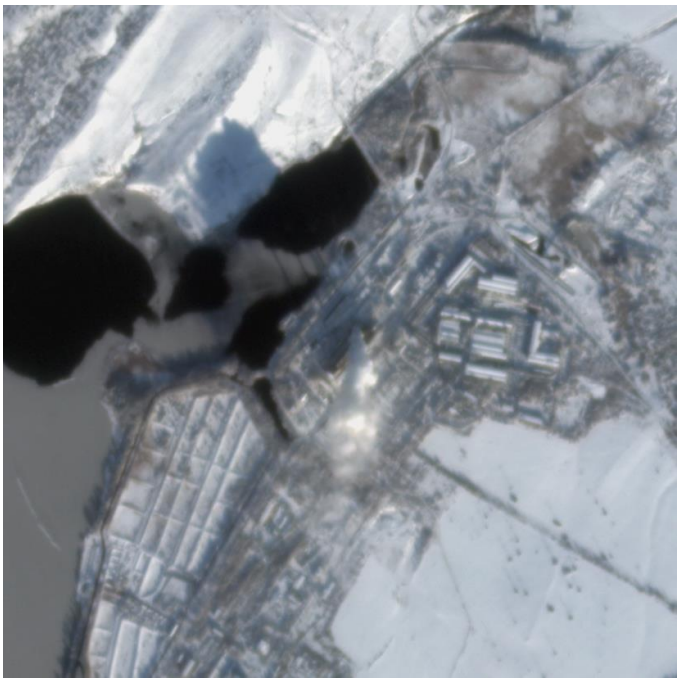
Myronivskyi power station, Coal, 275 MW mothballed – Vulcan Status: No Visible Damage

Plant has been under Russian control since May 2022 and sustained serious damage due to shelling in late 2022. https://www.gem.wiki/Myronivskyi_power_station

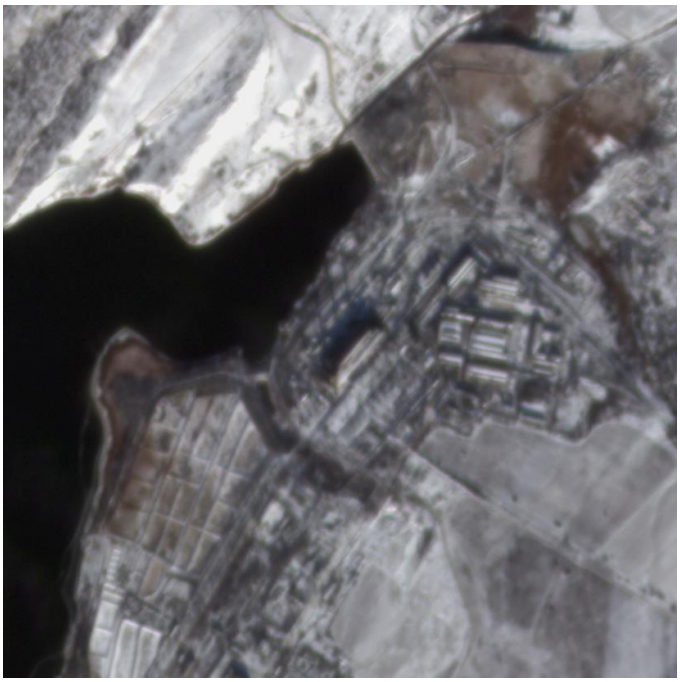
7/28/2021

8/25/2024

12/27/2021



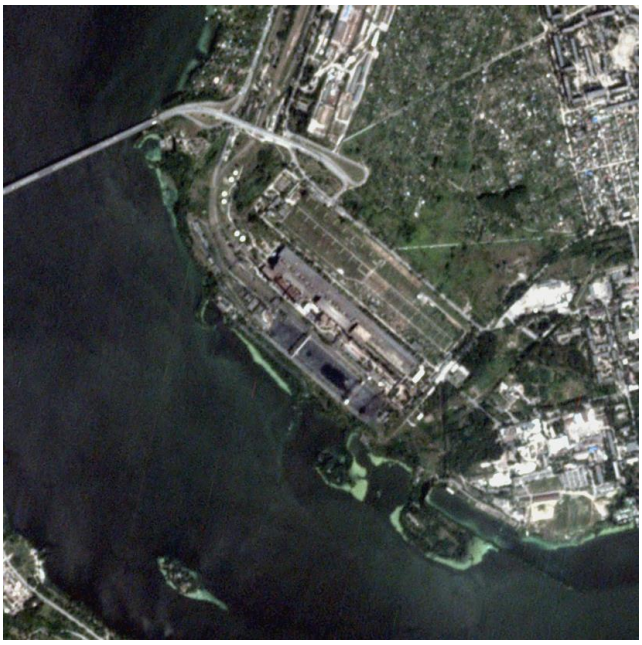
12/14/2024



Prydniprovska power station, Coal, 910 MW mothballed – Vulcan Status: No Visible Damage

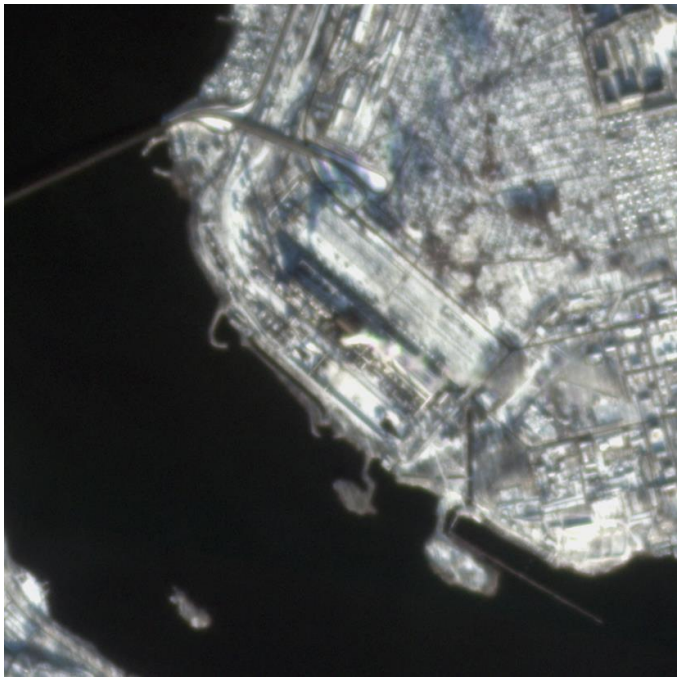
Plant appears operational 11/8/2024. Plant was attacked 2022-2024 suffering critical damage. https://www.gem.wiki/Prydniprovska_power_station

7/29/2021



8/30/2024

12/22/2021



11/8/2024

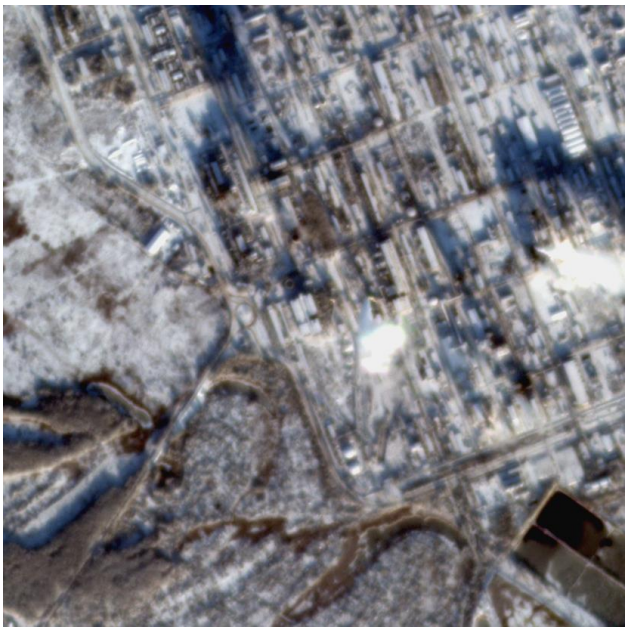
Severodonetsk CHP power station, Natural Gas, 270 MW mothballed – Vulcan Status: No Visible Damage

Plant was heavily damaged by Russian shelling in June 2022. As of October 2024 repair efforts were nearly finished to restore partial operations.
https://www.gem.wiki/Severodonetsk_CHP_power_station

7/30/2021

8/25/2024

12/27/2021



12/14/2024

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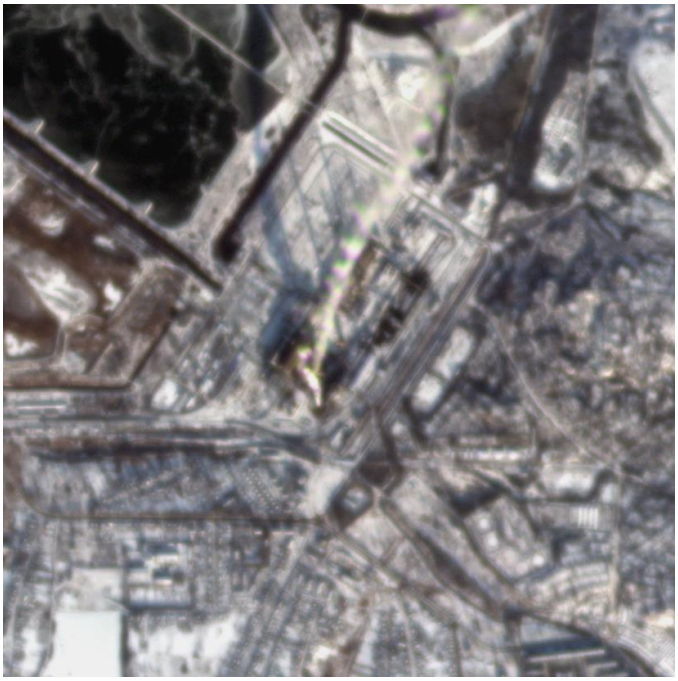
Slavyansk power station, Coal, 880 MW mothballed – Vulcan Status: No Visible Damage

Operation stopped in 2022 due to proximity of Russian forces, and sustained damage in attacks in 2024. https://www.gem.wiki/Slavyansk_power_station

7/28/2021

8/29/2024

12/24/2021



10/24/2024

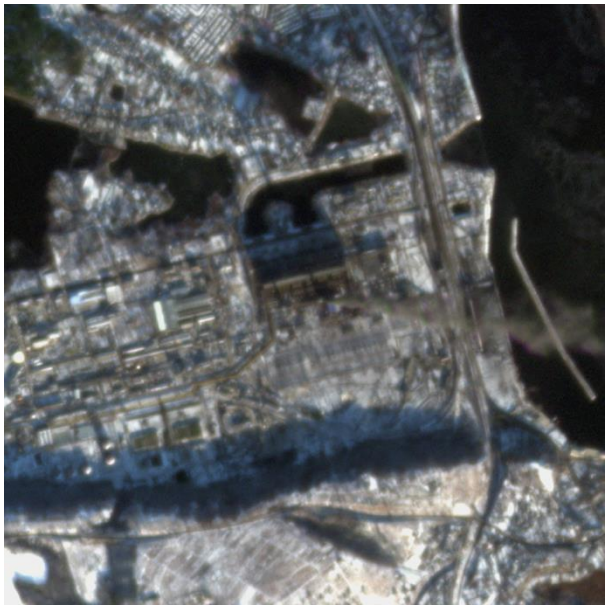
Trypilska power station, Coal, 1225 MW mothballed – Vulcan Status: No Visible Damage

Plant appears operational 12/14/2024. No exterior damage visible, plant is listed as mothballed/destroyed after an attack April 2024.
https://www.gem.wiki/Trypilska_power_station

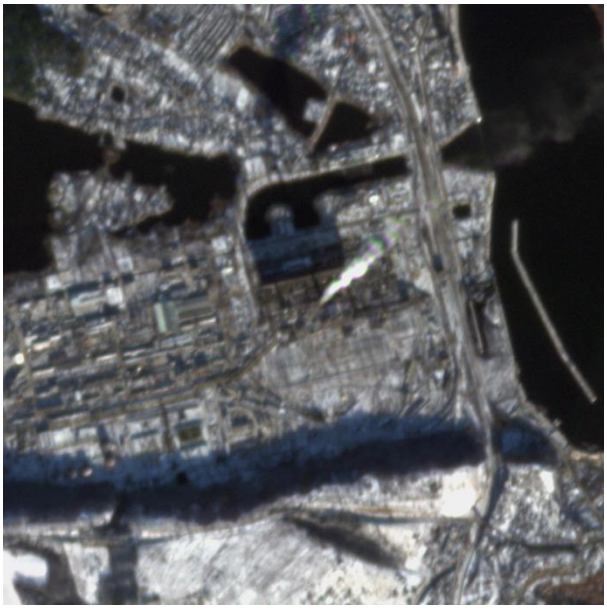
7/29/2021

8/29/2024

12/26/2021



12/14/2024



Vuglegirska power station, Natural Gas, 2400 MW mothballed, Coal, 1200 MW mothballed – Vulcan Status: No Visible Damage

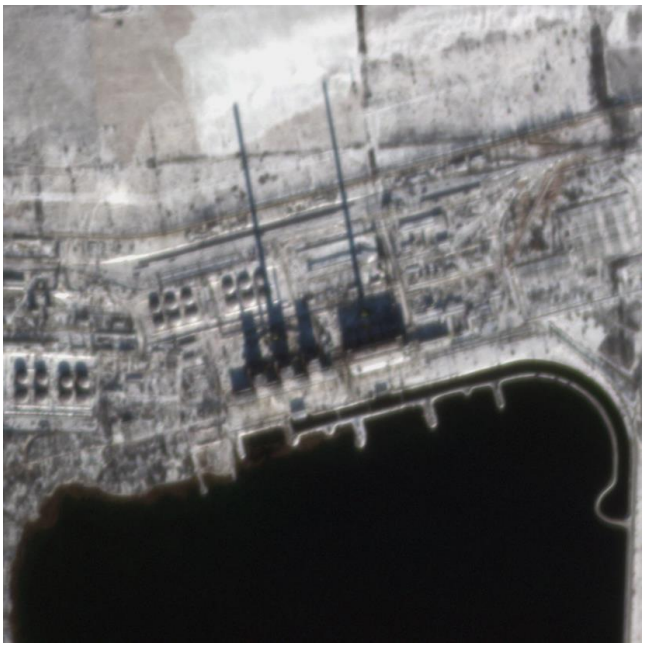
Gas pipelines were damaged in March of 2022 and the plant was occupied by Russian forces in July 2022. Efforts to restore the plant are ongoing.
https://www.gem.wiki/Vuglegirska_power_station

7/28/2021

8/25/2024

12/27/2021

12/14/2024



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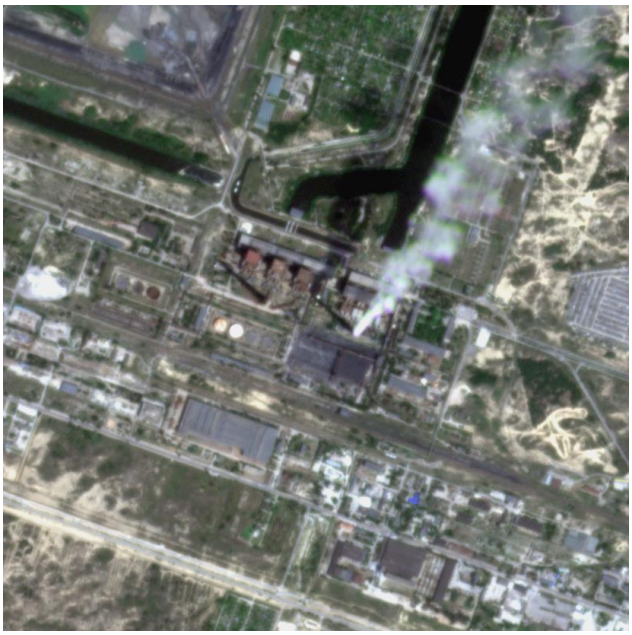
Zaporizhia power station, Natural Gas, 1600 MW mothballed, Coal, 1250 MW mothballed – Vulcan Status: No Visible Damage

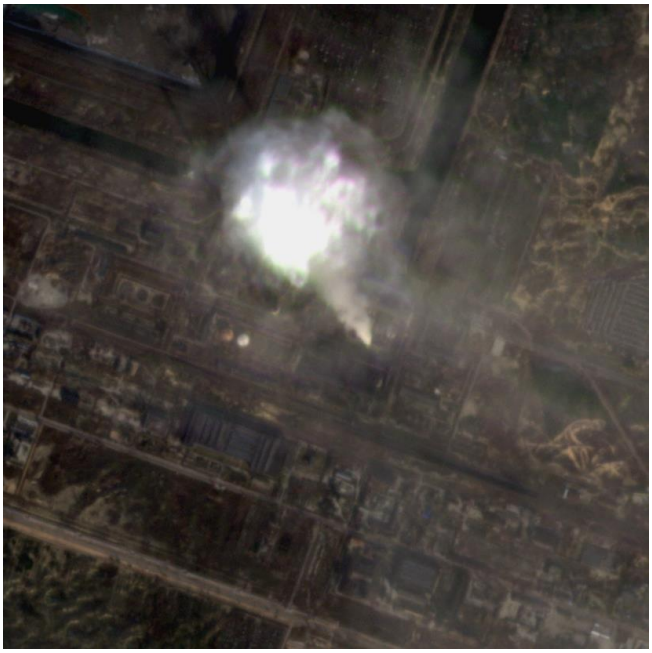
No exterior damage visible, plant is listed as mothballed since occupied by Russian forces. Plant plays a vital role in backup power supply for Zaporizhia Nuclear.
https://www.gem.wiki/Zaporizhia_power_station

7/29/2021



8/25/2024

11/25/2021



12/24/2024

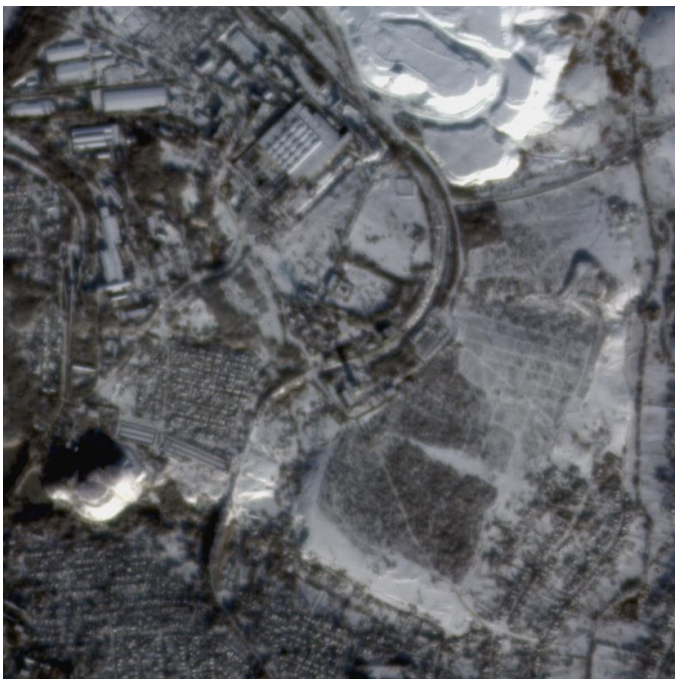
Zasyadko mines power station, Natural Gas, 72 MW mothballed – Vulcan Status: No Visible Damage

Operations ceased in 2021 due to shelling.
https://www.gem.wiki/Zasyadko_mines_power_station

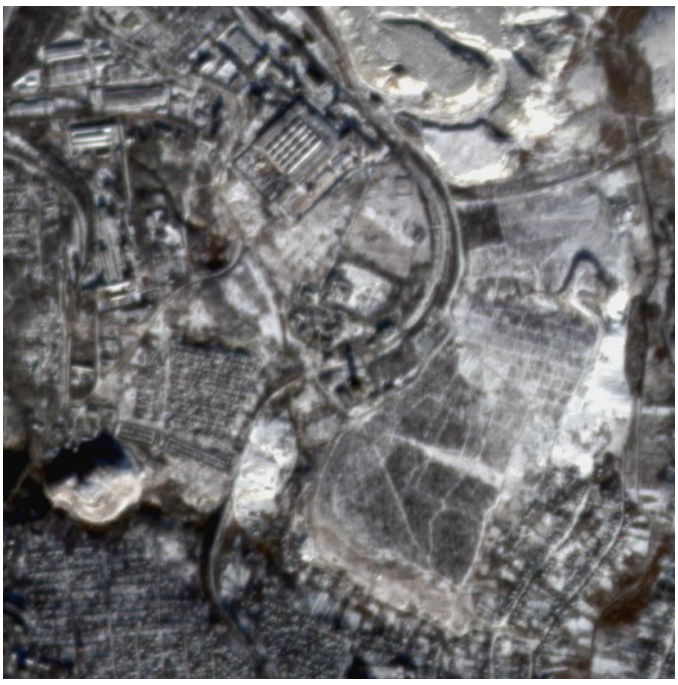
7/28/2024

8/29/2024

12/27/2021



12/14/2024



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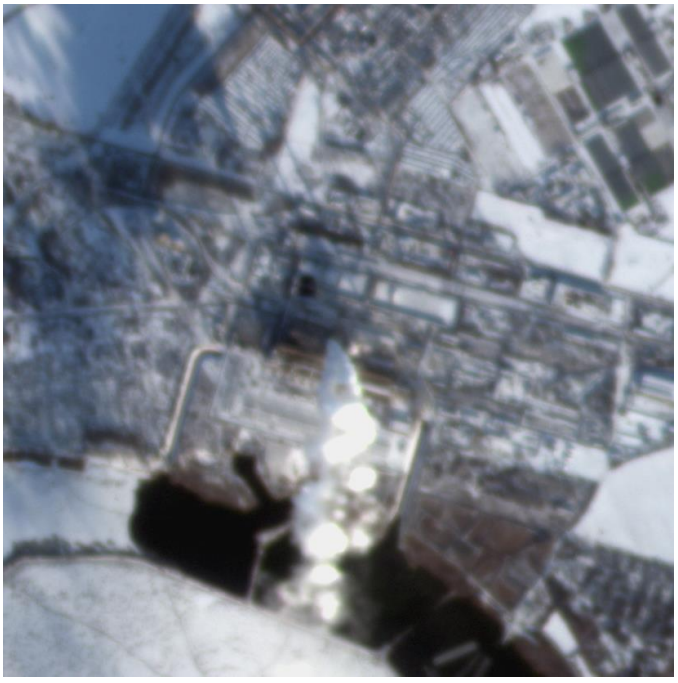
Zmiivska power station, Coal, 2270 MW mothballed – Vulcan Status: Damaged

Visible damage to roof. Plant was damaged March 22, 2024 and mothballed.
https://www.gem.wiki/Zmiivska_power_station

7/29/2021

8/29/2024 – Damage Visible

12/27/2021



10/30/2024 – Damage Visible

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