

# Russia-Ukraine war: Impact on the semiconductor industry

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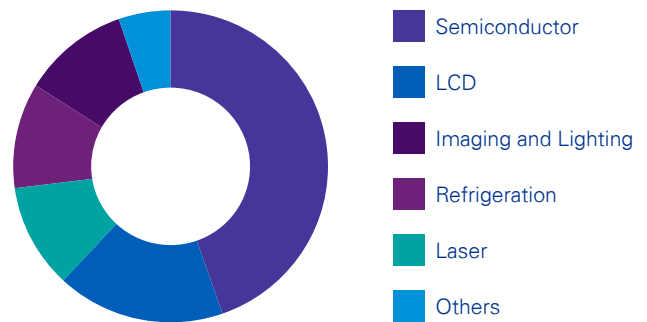
**The Russia-Ukraine war has the potential to further exacerbate semiconductor supply-chain issues and the chip shortage that has impacted the industry for the past two years. The most immediate risk is to the supply of specific raw materials such as neon and palladium that are used in semiconductor manufacturing. While the impacts of inflation and indirect supply-chain effects appears to be manageable in the near term, the potential for longer-term impact is yet to be determined and will be predicated on how events continue to unfold.**

## Supply of raw materials is at risk

Russia and Ukraine are major producers of two materials used in semiconductor manufacturing. Ukraine produces about 70-80 percent of the global supply of neon,<sup>1</sup> and Russia produces about 35 to 45 percent of the world's palladium supply.<sup>2</sup>

- **Neon:** Neon is used in the deep-ultraviolet (DUV) lithography process in semiconductor manufacturing, which accounts for about 45 percent of neon demand.<sup>3</sup> Neon is a byproduct of older types of steel plants, which still exist in Ukraine but have been phased out elsewhere (which is why supply is so concentrated). Technically, neon can be recycled and reused.<sup>4</sup> But not all semiconductor companies have made the investment to do so, preferring to stockpile the gas—despite the warning signs seen after the 2014 Russian annexation of Crimea, when neon prices spiked by 600 percent.<sup>5</sup>
- **Palladium:** The palladium supply is less exposed to the war, but shortages could affect both semiconductor production and demand. Palladium is used in plating applications in semiconductor production and is essential for catalytic converters. Automakers that can't produce vehicles because of catalytic converter shortages would also reduce chip orders.
- **Other materials:** Nickel, gold and silver are also important for semiconductor manufacturing. Russia is one of the top five global producers of nickel, but the nickel supply is less concentrated so the impact may be limited. Prices for gold and silver have also jumped. Semiconductor customers are usually on direct pass-through price agreements for such volatile, so they may feel the impact more than manufacturers will.

Global neon usage by application



Source, EMR, "Global Neon Gas Market Outlook"

<sup>1</sup> Source: Wired, "Russia's War in Ukraine Could Spur Another Global Chip Shortage," February 28, 2022

<sup>2</sup> Source: Barron's, "Russia Is One of the Biggest Producers of Palladium. Prices Climbed to a Record," March 4, 2022

<sup>3</sup> Source: EMR, "Global Neon Gas Market Outlook."

<sup>4</sup> Source: Hitomi Fukuda, "Chipmakers seek solution to neon gas supply shortage," Solid State Technology, March, 2016;

Source: Chris Ebert, Sig Stout, Karl Heimerl, and Matt Adams, "Neon recovery for photolithography," ASMC 2017 Proceedings, SEMI, 2017

<sup>5</sup> Source: Reuters, "Russia could hit U.S. chip industry, White House warns," February 11, 2022

## Short-term impact is manageable

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- Due to the 2014 Russian invasion of Crimea and the shortages of the last 18-24 months, many companies have put in place risk-mitigation plans. As a result, several key companies and industry alliances have said there will be no short-term impact due to lack of materials.<sup>6</sup>
- However, it is estimated that these mitigation plans can only prevent production disruptions for two to three months. The industry still depends on the region and can't quickly find effective alternative supply.
- This short-term impact is manageable assuming things will remain status quo in China.

## Long-term impact can be more serious

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- The semiconductor supply chain is extremely interconnected, and should tariffs and trade limitations be expanded, the complexity and cost for the industry will increase.
- Depending on how events unfold, there may be serious consequences with production line closures, price increases, and decreased output, revenues, and profits.
- However, we are not yet at this stage.

## Make contingency plans now

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- Short-term impacts on semiconductor production are expected to be manageable. But the war's effects on raw material prices, supply-chain constraints, and overall uncertainty will affect chipmakers and consumers.
- However, if the war continues, companies should be prepared for more severe supply-chain impacts.
- Once again, companies are advised to review all their business continuity plans, seek alternative sources of neon and palladium, and use forward pricing to protect against price fluctuations on other critical materials.
- In the medium term, companies must fully understand their supply chains and customer fulfillment networks so they can model the impact of potential disruptions from the war and sanctions. Longer-term, companies might also consider making more substantial investment in neon recycling technologies.
- Unless neon prices increase permanently, producing neon outside Ukraine isn't likely to become economical. But some governments may see it as a national security option.

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<sup>1</sup> Source: Reuters, "Russia could hit U.S. chip industry, White House warns," February 11, 2022

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