MAJOR TECHNOLOGICAL NETWORKS AND SOVEREIGNTY

Critical Infrastructure: Europe's vulnerability geography

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ABSTRACT

A rare transnational blackout suddenly exposed Europe's electrical infrastructure on November 4th, 2006: a giant technological system, which in everyday life secures energy to households and professionals, silently and invisibly.

It illustrates Europe's "hidden" infrastructure integration: From the first half of the 19th century onward, a variety of transport, communication, and energy networks integrated (and, in other cases, fragmented) Europe—in more direct and mundane ways than the formal economic and political integration process that started a century later. Today, modern societies and economies have become so dependent on uninterrupted infrastructure services, that they remain highly vulnerable to infrastructure disruption. The term Critical Infrastructure (CI) spotlights this vulnerability.

chemical pipelines map

The 'European blackout' of Saturday evening, 4 November 2006 was remarkable. In Northern Germany, close to the North Sea, a high-voltage transmission line had been purposefully shut down, and contingencies caused a second line to overload and shut down. As the electricity sought alternative pathways, more lines overloaded and switched off. Within 20 seconds the failure had cascaded to the Mediterranean. From Croatia to Portugal lights went out, and people were trapped in trains and elevators. Via the Spain-Morocco high-voltage cable the failure even hit Morocco, Algeria, and Tunisia.

Critical infrastructure (CI)

The policy concept CI emerged in the mid-1990s. After hackers broke into the CIA, US Air Force, Department of Defense, and Citibank computer systems via the Internet, an American presidential Critical Infrastructure commission urged protection of infrastructure critical to the economy, society, and administration. The infrastructure-related terrorist attacks of 11 September 2001 in the USA (using aircraft as weapons), Madrid 2004 (targeting commuter trains), and London 2005 (targeting subways and buses) added urgency. So did major technical failures such as the Italian blackout of 2003, and the Russia-Ukraine gas crisis and European blackout of 2006. The EU enacted its own CI policies to protect "the vital societal functions, health, safety, security, economic or social well-being of people" (Council Directive 2008/114/EC). Its policy effectivity has been severely questioned, but its diagnosis is telling: Europe's Member States share risks, due to common energy, ICT (Information and Communication Technology), transport, water, food, health, financial, chemical, nuclear, military, and other infrastructure.

Cross-border connections

EU policy documents distinguish between two types of vulnerable European infrastructure interdependencies: interdependencies across national borders, and interdependencies across sector boundaries.

There is now a considerable historical literature on Europe's interdependencies across borders. From the first half of the 19th century national governments, private consortia, and international organizations coordinated, financed, and built a host of cross-border transport, energy, and communication networks. Their priorities and choices shaped Europe's infrastructure geography and its vulnerability legacies.

Europe's electrical integration is a case in point: Since the 1920s engineers and policy makers have worked on European electricity connections for energy trade and reliability—electricity import could compensate for domestic breakdown. Technology choices mattered. In Western Europe, most power companies interconnected at a common synchronized frequency, operating their systems 'in tune'. This means that partners automatically stabilize each-others system—instabilities will be absorbed and counteracted by the partners' equipment. But such systems can occasionally transmit cascading blackouts. And so in 2006 an incident in Northern Germany could disrupt power supply in Italy and Portugal, and even Morocco, Algeria, and Tunisia, synchronously connected from 1997.

Much closer to the incident, East-Denmark, Sweden or the UK were not affected. In the 1950s and 1960s, their power authorities had opted for less direct, so-called asynchronic connections; the UK eschewed full interdependency with France, while the Nordic countries found synchronization too expensive. The 2006 vulnerability geography of the 'European blackout' therefore included Tunisia, but excluded the UK and Scandinavia. Similar analyses can be made for other infrastructure.

Cross-sector connections

Vulnerabilities also arose because of interdependencies *between* sectors: a crisis in one CI sector can disrupt the other. A serious electricity or Information and Communication Technology (ICT) failure can disrupt much social life and practically all sectors of the economy. Historical research on the making of such cross-sector entanglements is in its infancy, but we know some of the dynamics involved.

Inter-sector interdependencies, too, have developed over centuries. For instance, financial services became highly entangled with ICT infrastructure—financial markets are ICT-based, workers receive wages through automatic payment systems, and households rely on on-line banking, card payments in shops, and cash machines in streets. For financial markets this entwinement goes back to the mid-nineteenth century, when bourses and brokers lobbied for and invested in electric telegraph connections to other bourses to gain information advantages.

Telegraph networks henceforward co-evolved with telegraph-based financial systems, by 1914 forming a global network of about a 120 ICT-connected stock exchanges. Fast communication meant trade advantages, so financial agents kept on investing in their ICT backbone, from dedicated open telephone lines, radio and fax connections, to today's glass fiber and laser connections of High Frequency Traders.

Energy infrastructure and heavy industry became likewise entangled. For instance, the organic chemical industry emerged from the mid-19th century, when entrepreneurs started to use coal (and later oil and natural gas) as feedstock for an increasing range of products. Illustratively, during the Cold War Western Europe's petrochemical plants were connected to the global oil shipping infrastructure of Shell, Total, BP and others. In Eastern Europe, by contrast, the *Druzhba* (friendship) pipeline fed oil from Tatarstan and Samara to industrial complexes from the GDR (German Democratic Republic)to Poland to Yugoslavia. Today, the industry remains dependent on tankers and chemical pipelines crisscrossing Europe.

Nature as Critical infrastructure

Finally, despite the ecological crisis, ecological infrastructure is notoriously absent in CI protection lists. Yet 'green infrastructure' (as it was called since ca. 1980) displays the same CI features.

The 'cross-sector' interdependencies of green infrastructure, that is, criticality of green infrastructure to economy and society, dominated anthropocentric initiatives of ecological network building in Estonia, Lithuania, and Czechoslovakia from the 1970s. Inspired by the planning concept of 'functional zoning', interconnected ecological zones should purify air, clean water, prevent erosion, thereby underpinning urban, industrial and agricultural zones.

The 'cross-border' interdependencies of green infrastructure became especially prominent in the Western, nature-centric ecological network concept. These ecological networks served biodiversity for its own sake—linking up nature reserves by ecological corridors in larger networks theoretically increases habitat size and thereby biodiversity. Most encompassing is the pan-European ecological network project, endorsed by forty-six governments in the mid-1990s, and planning ecological corridors between unconnected nature zones from Siberia to Portugal, to facilitate the circulation of plants and animals.

Among other Critical Infrastructure, green infrastructure stands out as extremely vulnerable, since road constructions and urban development fragment nature much faster than nature conservationists can possibly compensate for.

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