Effects of Prolonged Electricity Disruptions on Critical Entities

Critical entities are the nervous system of modern society. They maintain vital functions like internet connection and drinking water supply. In this era of power system transformation and rising security threats, critical entities unprepared for prolonged power disruptions risk significant societal impact.

Ongoing transformation of the Swedish power system and uncertainties in European electricity supply[1] have been accompanied by a degraded security situation. The latter includes infrastructure sabotage near Sweden and open attacks on Ukraine's energy apparatus[2]. This emphasises the importance of considering effects from prolonged electricity disruptions. In our increasingly interdependent society, disrupting critical entities such as hospitals or telecommunication operators could entail severe consequences to important societal functions. Analysing how they are affected enables informed mitigation and adaptation. Furthermore, ongoing expansion of Swedish preparedness and total defence[3] brings legal and ethical incentives to address the issue.

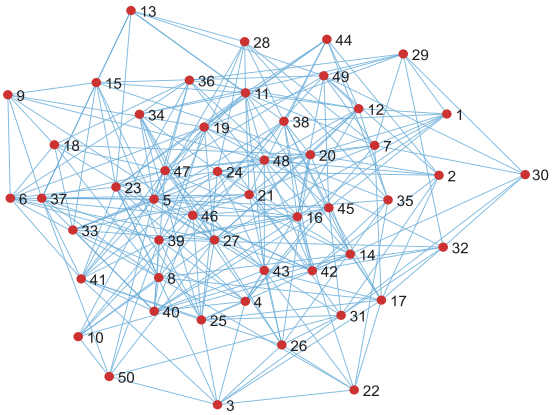

Illustration A. Interconnectedness of modern society visualised as dependencies between 50 critical entities.

Using expert elicitation Hansson[4] has shown that critical entities are vulnerable to outages, but also that consequences are not necessarily worsened in prolonged scenarios. However, function varies substantially between actors, and uncertainty grows as duration is prolonged. It is demonstrated that entities are strained if outages occur combined with contextual factors like grey zone activities or war, where inadequate staffing and supply flows negatively impact function maintained.

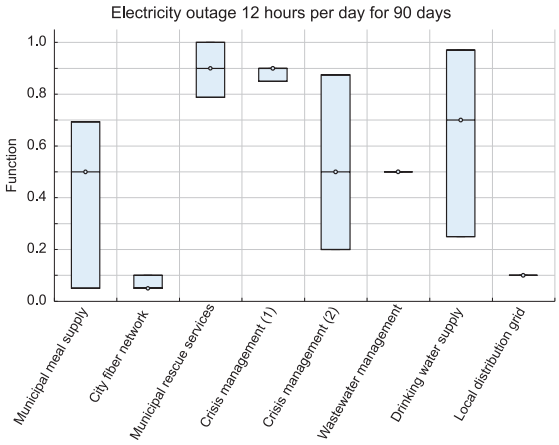

Illustration B. Example of varied function during prolonged outages, where boxes cover plausible intervals and circles mark best assessments[4].

Although this underlines a need for improvement measures tailored to individual entities, common threads include improved supply solutions, joint coordination with interdependent actors, and alternatives to diesel-fuelled auxiliary power. Adequately assigned deployment duties are essential for entities to withstand electricity disruptions during heightened alert and war. Most examined entities relied on diesel auxiliary power. It indicates wide societal dependence on diesel supply, which might be unreliable in times of large-scale disruption. Expansion of intermittent energy sources is sometimes feared to decrease reliability in Swedish power supply – but capitalising on potential synergies, e.g. solar or city-level battery storage facilities for islanding, might be a timely effort to increase critical entities resilience against electricity disruption.

André Hansson, May 2023

[1] Swedish Energy Agency. (2023). *ER2023:07.*

[2] MUST. (2023). *MUST Årsöversikt 2022.* Swedish Armed Forces.
Swedish Security Service. (Nov 2022). *Confirmed sabotage of the Nord Stream gas pipelines.* Retrieved from sakerhetspolisen.se

[3] SOU. (2021:25). *Struktur för ökad motståndskraft.*

[4] Hansson, A. (2023). Effects of Prolonged Electricity Supply Disruptions on Critical Entities. Lund University.