

CYBER OPERATIONS AND CRITICAL INFRASTRUCTURE DISRUPTION IN CONFLICT

Will Cyber Replace Kinetic Effects?

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OPERATION ABSOLUTE RESOLVE, 2026

 BankInfoSecurity

Trump, the US and a Blackout: What Cut Off Venezuela's Grid?

 Forces News

How cyber can hack air defences, bring down a leader and plunge a city into darkness

 GV Wire

Cyberattack in Venezuela Demonstrated Precision of US Capabilities

 POLITICO.eu

NATO's Rutte says Europe must prepare for 'scale of war our grandparents' endured

 DutchNews.nl

Dutch businesses urged to make plans for blackouts and attacks

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WILL CYBER SUBSTITUTE KINETIC DISRUPTION?

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The Question

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What Makes Cyber Attractive?

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Investigative Framework.

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Venezuela.

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Pre-Conditions And Their Significance.

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Ukraine: Cyber As Part Of A Broader Disruption Toolkit.

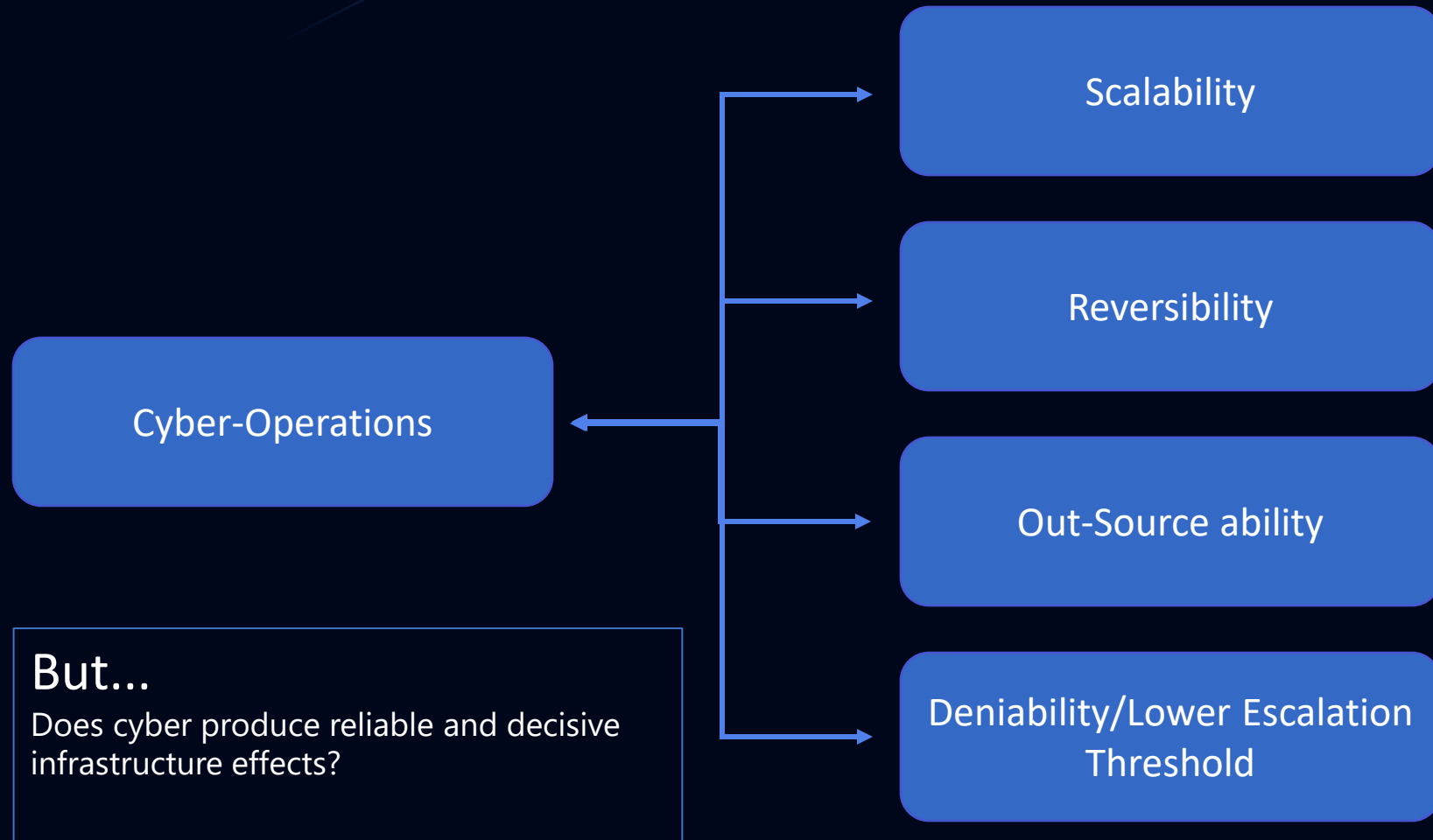
07

Substitution Versus Fusion.

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Implications for Operators and Stakeholders.

WHAT MAKES IT ATTRACTIVE?



FRAMEWORK: DISRUPTION AND SUBSTITUTION

- **Cyber disruption:** the degradation, denial, manipulation, or loss of infrastructure function caused through interference with digital systems, communications, software, or control environments.
- **Kinetic disruption:** degradation, denial, or destruction of infrastructure function caused through direct physical force against assets, facilities, or people.
- **Operational substitution:** ability to independently produce effects comparable to kinetic means.



FRAMEWORK: ASSESSING A "CYBER" DISRUPTION

- **Duration**
- **Geographic Scale**
- **Severity of Service Loss**
- **Loss of control**
- **Recoverability**
- **Cascading effects**
- **Strategic utility**
- **Dependency on physical conditions**

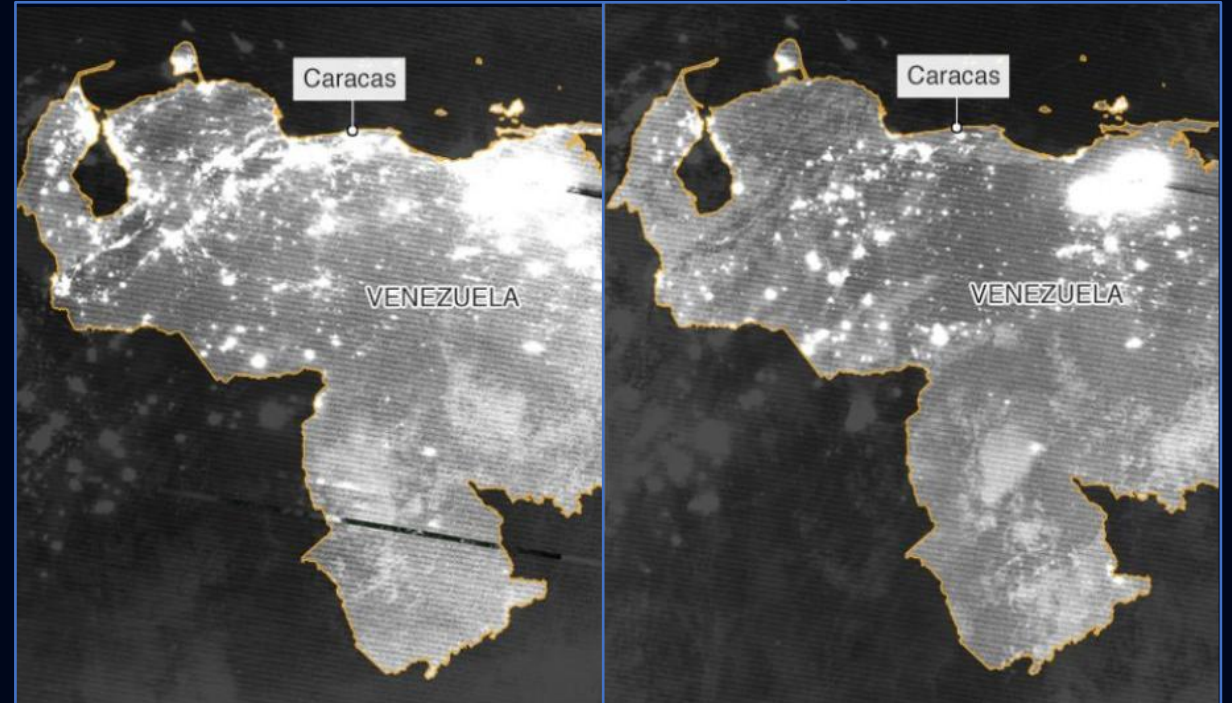


VENEZUELA 2019

Severe blackout: significant scale, service loss, and second order effects.

Cause:

- Allegedly - US Cyber Intervention (refuted)
- Likely - Cascading System Failures caused by Maintenance Issues



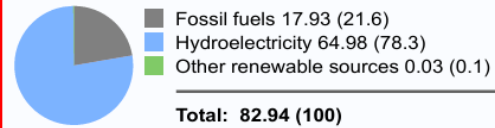
Venezuela's Energy Infrastructure under Economic Hardship and severe US Sanctions

- Endemic Systems Maintenance Issues
- Human and Intellectual Capital Issues
- Critical dependencies/missing redundancies

VENEZUELA 2019

Venezuela • Electricity

Gross electricity generation 2023, TWh (%):



Source: Based on the U.S. Energy Information Administration data (Jan 2025).

Hydro power plants over 80 MW, MW:

- 1 Guri (Simon Bolivar), 10 200
- 2 Macagua (A.Jose de Sucre), 3167
- 3 Caruachi (Francisco de Miranda), 2160
- 4 Tocomá (Manuel Piar), 2160
- 5 La Vueltoza (Fabricio Ojeda), 514
- 6 San Agaton (Leonardo Ruiz Pineda), 270
- 7 Pena Larga (Juan A Rodriguez Dominguez), 80

Gas power plants over 100 MW, MW:

- 1 El Sitio, 1080
- 2 India Urquia, 1080
- 3 Termo Barrancas, 342
- 4 S. Pedro Camejo, 300
- 5 El Furrial, 232

Combined power plants over 450 MW, MW:

- 1 Planta Centro, 2000
- 2 Tacoa (Ricardo Zuloaga), 1720
- 3 Termozulia I-II-III-IV, 1590
- 4 A. José de Sucre (Cumana), 1000
- 5 Ramon Laguna, 660
- 6 Don Luis Zambrano, 560
- 7 Tamare, 470*
- 8 Josefa Camejo, 450
- 9 Oscar Augusto Machado, 450
- 10 Bachaquero, 450

* under construction

Oil power plants over 100 MW, MW:

- 1 Margarita & Josefa Rufina, 342
- 2 San Lorenzo, 103
- 3 Barinas, 100

- 765 kV line in service
- 400 kV line in service
- National grid 765 kV of other power plants, grid connection points, substations
- National grid 400 kV of other power plants, grid connection points, substations
- Border crossing

In 2023 Venezuela had 33.5 GW of electricity installed generating capacity. Gross theoretical hydropower capability, related to Venezuela, is 731.0 GWh/year. Hydropower is a major energy resource in Venezuela with a total installed capacity of up to 15.4 GW in operation, generates roughly 77.0 TWh energy annually. As of 2020, Venezuela registered 7 small-scale hydropower plants with a total installed capacity of 1.4 MW.

Sources: U.S. Energy Information Administration (2025); World Small Hydropower Development Report 2022; Used by permission of the World Energy Council (2013).



www.aenert.com

VENEZUELA 2026 - OPERATION ABSOLUTE RESOLVE

Objective: Isolate and capture leadership.

Energy Disruption:

Criteria	Rating
Duration	Low (Hours)
Geographic Scale	Moderate (City-Regional)
Service Loss	Significant
Strategic Utility	Severe
Dependency on Physical Conditions/Action	High

Why High?

- Pre – Conditions as discussed.
- Significant physical damage to at least three Venezuelan substations.

Thus: Not real Substitution

PRE-CONDITIONS AND THEIR SIGNIFICANCE

Endemic physical
maintenance deficiencies

Insufficient redundancy
and resilience

Weak cybersecurity
architecture and
hardening

Inadequate detection and
incident response
capabilities

Operational and
workforce limitations

Critical (inter) dependencies
and cascading failure
potential

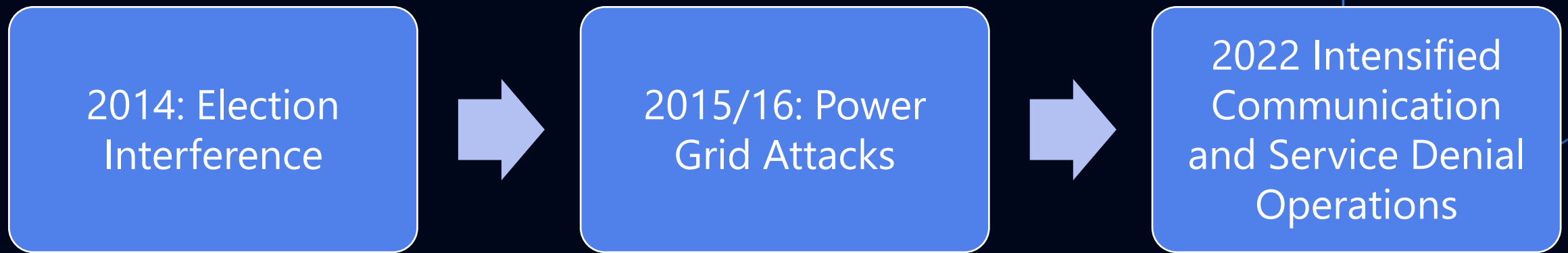


UKRAINE: CYBER MEETS KINETIC WARFARE

Energy Infrastructure Disruption:

- Assumptions hold: cybers success depends on (physical) pre-conditions
- Cyber Only: not a significant disruptor (according to our scale)
- Mainly employed in sequence with physical effects on target or area of operations
- Kinetic means remain predominant disruptor.

Trends: Shaping the Battlespace; Cyber – Kinetic Warfare Integration



VIASAT EXAMPLE

February 2022

Cyber Attack:

- AcidRain malware
- Thousands of satellite modems disabled

Purpose:

- Degrade Command and Control (C2) Capabilities
- Reduce Situational Awareness
- Hinder Mobilization
- Support maneuver warfare/invasion



VIASAT EXAMPLE

Disruptive Effects (Key Observations):

- Initially: severe degradation of key Military & Government comms systems
- Duration: varying "relatively short recovery times (hours –first days)
 - Spill Over: private and commercial users effected longer.

Cyber did not:

- Collapse Ukrainian command structure
- Cause long-term/large-scale outages
- Deliver decisive strategic effects

It did:

Create significant disruption during key phase of operation

Act as a force multiplier

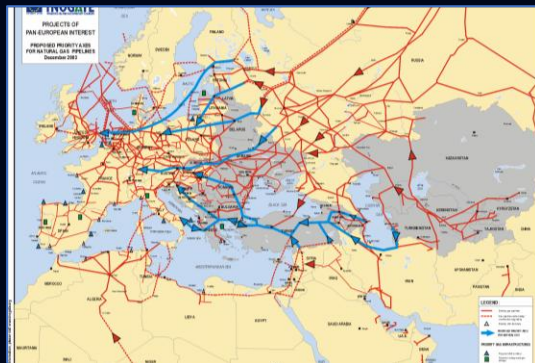
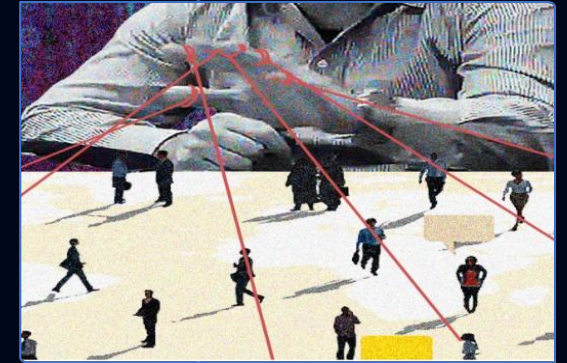


FUSION INSTEAD OF SUBSTITUTION

Cyber-Operations

Support

Kinetic-Operations

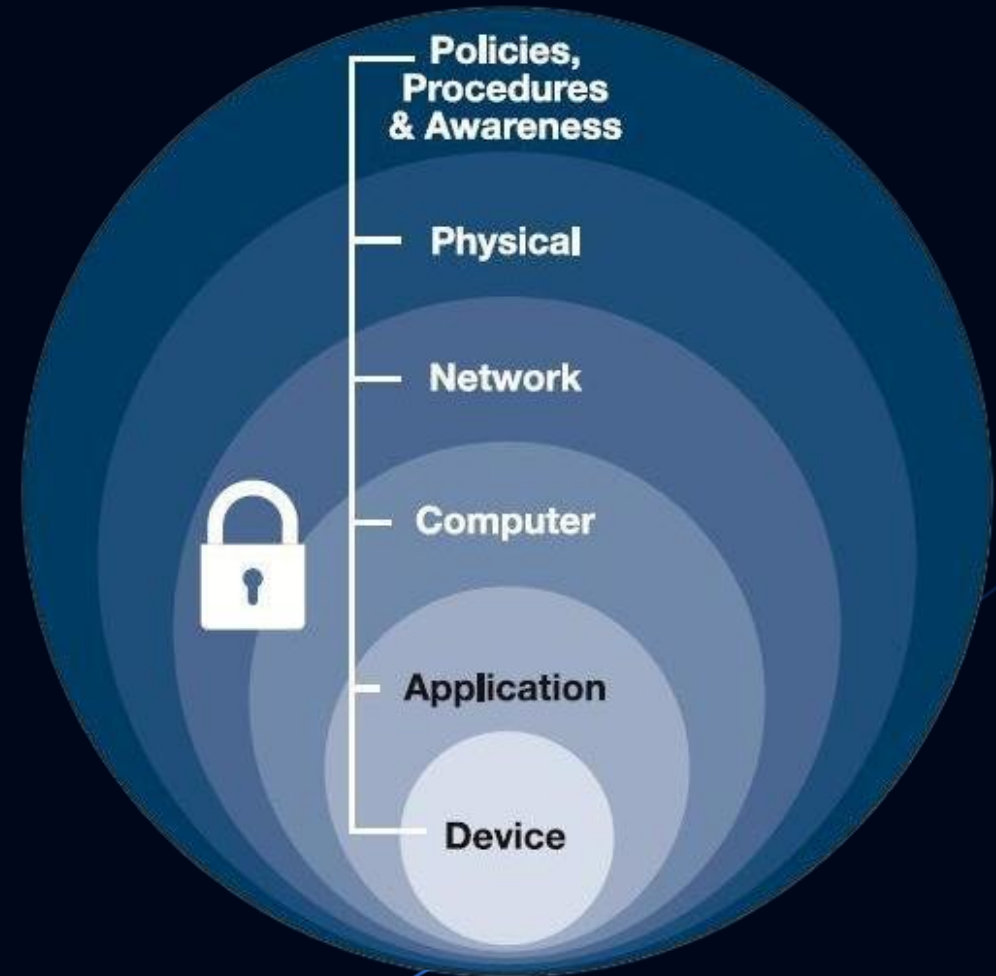


Implications for Infrastructure operators

Prepare for Hybrid Threats

- Secure digital perimeter
- Secure physical perimeter
- Practice manual recovery and operations
- Assume supply-chain compromise
- Improve resilience and recovery

You cannot fully trust every component. You must secure the environment around it.



Short and Simple: Will Cyber substitute Kinetic Effects?

Predominantly?

Unlikely. Cyber capabilities are most effective when integrated with physical operations rather than used as a substitute for them.

Takeaway for Operators

Prepare for **combined threats**, not isolated cyber incidents.
Control what you can control.

Don't think only about how you can be compliant for today, think about how you can be prepared for tomorrow!

THANK YOU | GET IN TOUCH

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