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Resilience Quantification Through the Protective Relaying: A Metrics Review

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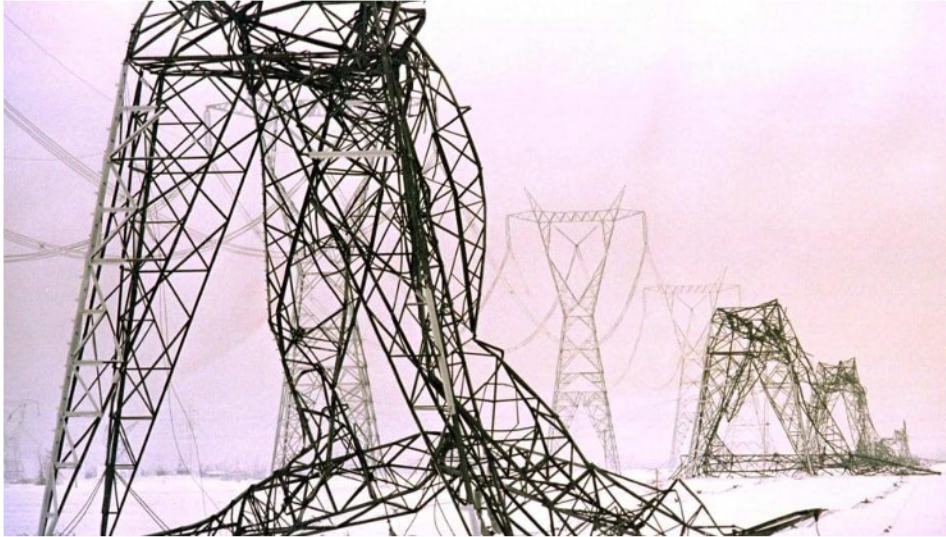
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Source: Emaze, <https://app.emaze.com/@AOIWZORWO#2>

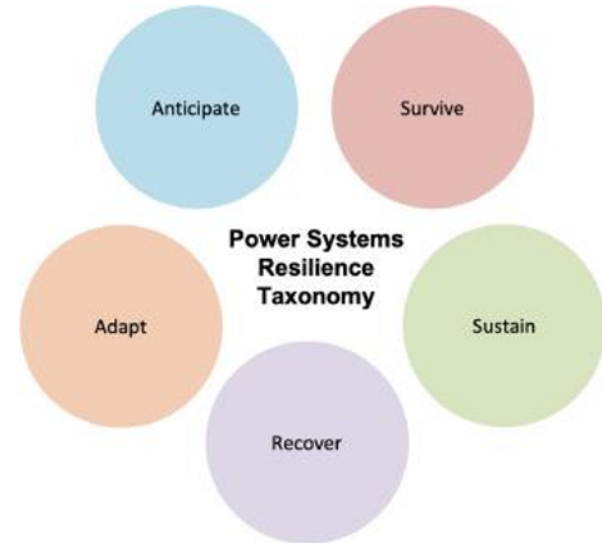
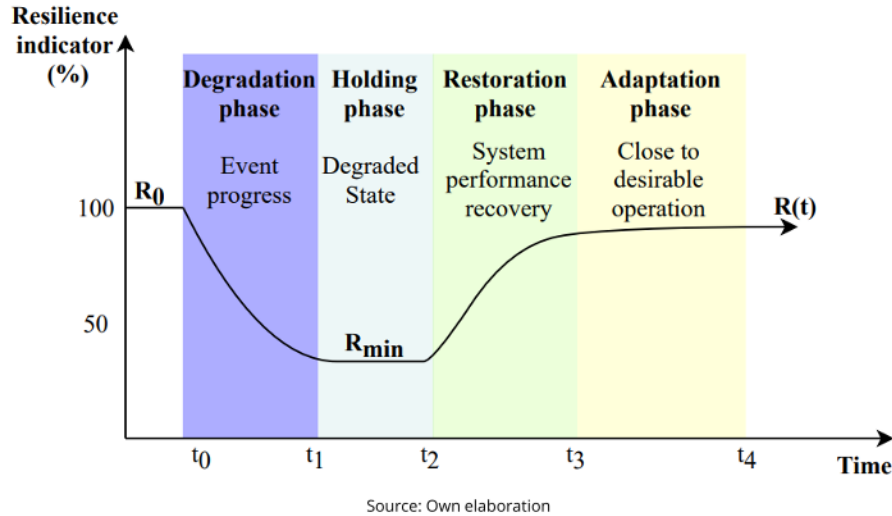
I. Introduction



Source: <https://www.montana.edu/msesl/research/Power-System-Resiliency.html>

Why to consider a **resilience design** approach?

II. Theoretical aspects



Source: Power systems resilience: Definition and taxonomy with a view towards metrics, 2021

II. Theoretical aspects

Infrastructural strategies

- Line hardening
- Repair crews

Operational strategies

- Network reconfiguration
- Feasible islanding
- Demand response and load shedding programs

Planning strategies

- Preventive allocation
- Vulnerability analysis



Source: <https://maestros.com.co/>

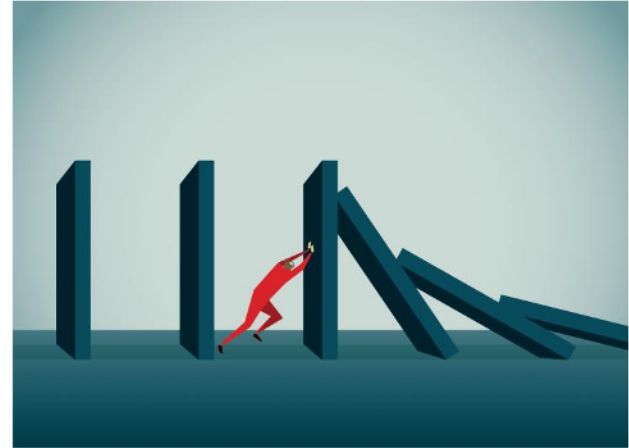
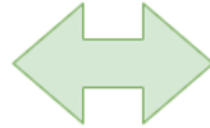


Source: <https://agriculturaglobal.com/articulos/micro-redes-el-futuro-de-las-energias-renovables>

III. Reviewed aspects

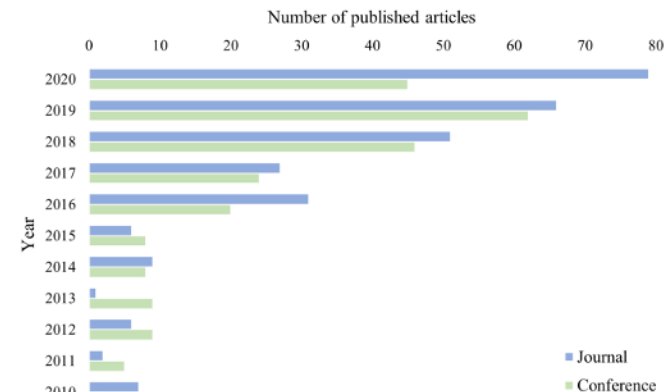
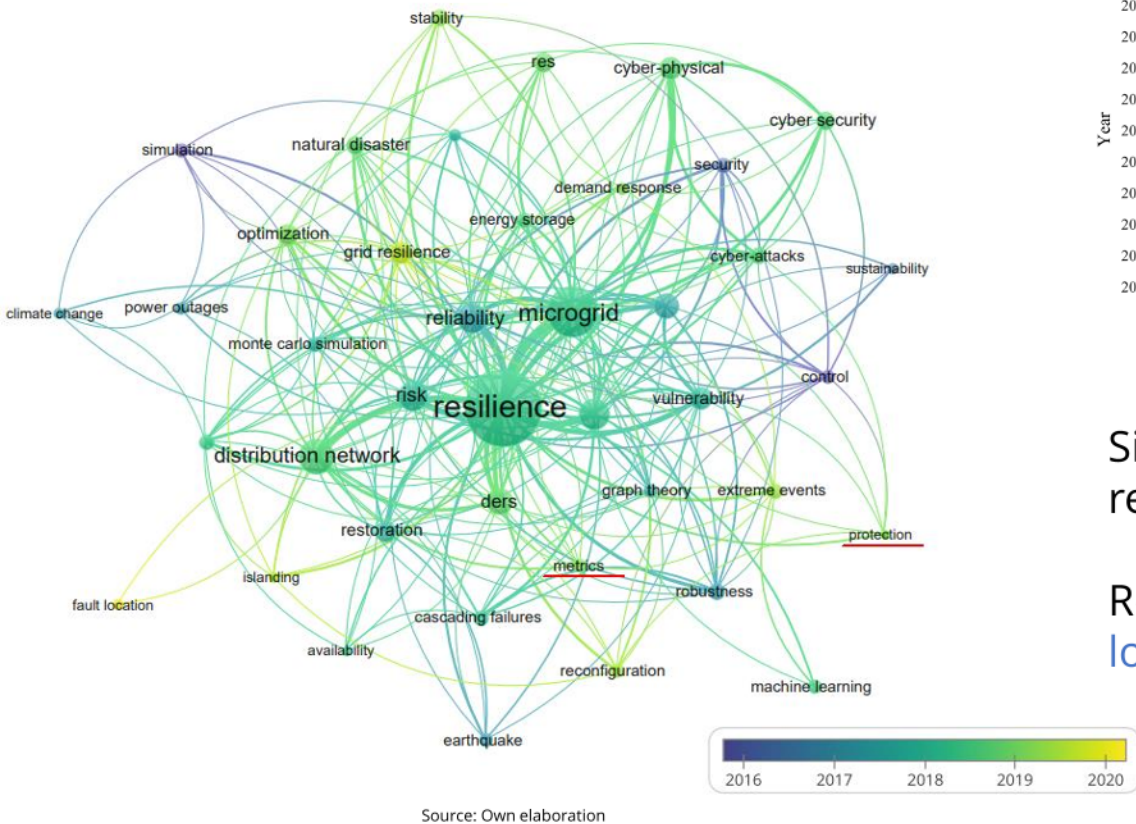


Source: <https://www.mitre.org/publications/project-stories/predicting-and-preventing-power-outages-across-the-national-electric>



Source: <https://techcrunch.com/2019/01/10/resilience-tech/>

- Find the relation between **resilience** and **protections**
- Search an **indicator** suitable for measuring the resilience improvement level achieved by the protection system.

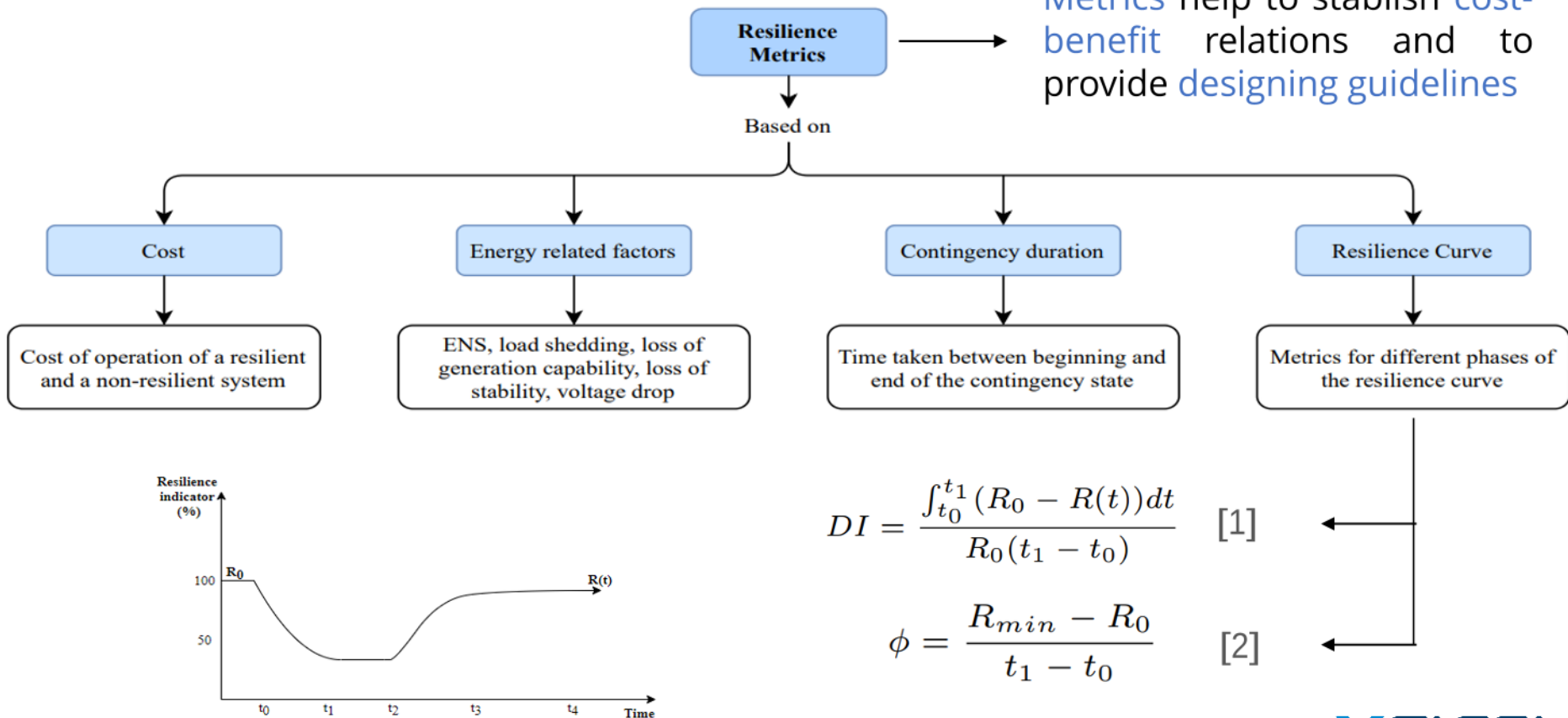


Significant **growth** in power systems resilience articles after **2016**

Resilience and protection have still **low relation**, but it is a **recent topic**

IV. Progress and gaps

Metrics help to establish cost-benefit relations and to provide designing guidelines



V. Conclusions

- There are **no standardized resilience metrics** yet, so far, several authors have proposed empirical metrics but they can widely vary between authors.
- The metrics may be based on aspects such as **cost, energy variables, contingency duration** and the **resilience curve**.
- Resilience **curve based metrics** are suitable candidates for measuring the resilience improvement level through the **protection** system, but more approaches can be also explored.

References

- [1] M. Amirioun, F. Aminifar, H. Lesani, and M. Shahidehpour, “Metrics and quantitative framework for assessing microgrid resilience against windstorms,” *International Journal of Electrical Power & Energy Systems*, vol. 104, pp. 716–723, 2019.
- [2] M. Panteli, P. Mancarella, D. N. Trakas, E. Kyriakides, and N. D. Hatziargyriou, “Metrics and quantification of operational and infrastructure resilience in power systems,” *IEEE Transactions on Power Systems*, vol. 32, no. 6, pp. 4732–4742, 2017.

VI. Questions

