DeSIRE tenure track position #6: Cyber-physical energy system resilience

University:	Delft University of Technology
Faculty:	Faculty of Electrical Engineering, Mathematics and Computer Science
Department:	Department of Electrical Sustainable Energy
Responsible Professor:	Prof. Peter Palensky
Expected to open:	This position is expected to open around January 2019

Description:

Energy systems (and by that explicitly not only the electricity system is addressed) are tightly intertwined with information technology, for controls, data acquisition, and analytics. This automated, networked, instrumented, and finally cyber-physical energy system of the future not only inherits the benefits (e.g., efficiency, agility) and problems (e.g., complexity, cyber attacks) of the IT domain, it also creates entirely new possibilities to solve problems on both sides. System resiliency can and should be supported from both sides: the physics side, by designing self-stabilizing controls or by designing for contingencies and partial failures, and the cyber-side, by harmonizing intrusion and anomaly detection systems or by hardening the IT/OT (information technology / operational technology) infrastructure.
Stability, robustness, immunity, observability, and other aspects of cyber-physical resiliency, however, can even be more improved by having a holistic approach for cyber-physical systems. We need new tools, methods, and thinking/culture for that. An anomaly detection system can for instance be greatly improved, if it does not simply detect deviations from a statistical model but is given a grey-box model of the system in order to check for plausible system states. It is the seamless combination of the cyber- and the physics aspects that must be exploited in designing resilient systems.
This position will work on new methods to assess cyber-physical properties of complex systems, such as stability margins, complex system-of-system dependencies, or robust model-based operations. The methods combine analytical and numerical principles, as the size and complexity of the investigated systems render established, monolithic methods typically useless.
The topic is rich enough to install an entire group working on cyber-physical energy system resiliency, covering numerical simulations, statistical learning, modeling, and defining and assessing resiliency metrics. The Tenure Tracker will be the center point, leading this group, financed by projects acquired by her/him.

Postion in framework of the programme (please delete what is not applicable):

- Approaches/discipline:
  mathematical modelling/ cyber-physical modelling/ cross-cutting methodologies/ Cyber Resilience & AI for Resilience
- Scale/application area:
  Cities & regions of interconnected mid-size towns/ Urban – Infra, national and continental level

Synergy with other tenure track position(s):

- Monitoring the resilience of artificial and natural infrastructure in cities and urbanized deltas (UT, Engineering Technology)
- Life Course Epidemology: Modelling Resilience (TU/e, Mathematics and Computer Science)
- Electromagnetic energy conversion for a more resilient society (TU/e, Electrical Engineering)