Ensuring adaptive behavior of CEI infrastructure

Session 1: Mitigating Security Risks to Critical Energy Infrastructure

9TH INTERNATIONAL FORUM ON ENERGY FOR SUSTAINABLE DEVELOPMENT , Kiev

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Risks related to Critical en.Net

- **<u>Human Factor</u>** : represents **80% of all events**
  - **Human unintentional**
    - Human failure of Control room operator..
    - Maintenance crew.. **Training needs**
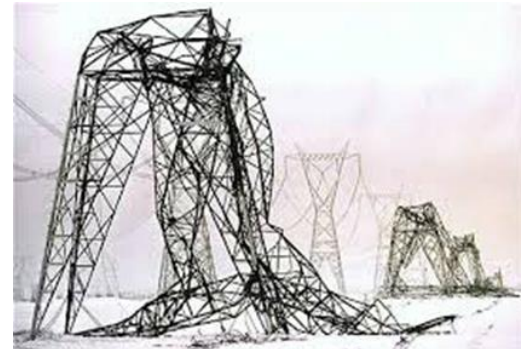 - **Human-intentional**
  - Cyberterorizmus, Destruction, manipulation
  - **<u>Natural disasters</u>** :
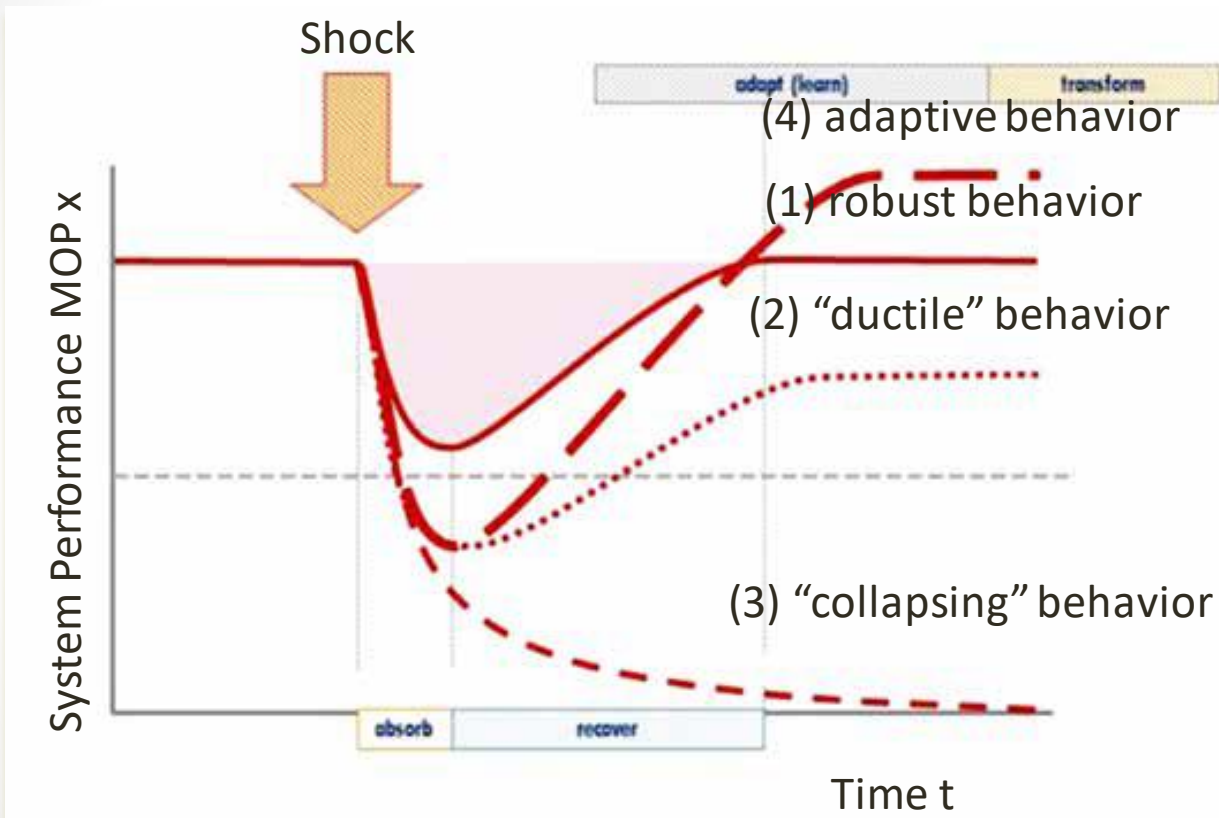 - Heavy rains
  - earthquakes
  - Land slides
  - floodings
  - avalanches
  - storms
  - Extreme temp…
  - **<u>Technical failures</u>**
  - Line break, Tower break, Transformator

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Protection of CEI

Shock

(4) adaptive behavior

(1) robust behavior

(2) "ductile" behavior

(3) "collapsing" behavior

System Performance MOP x

Time t

adapt (learn) | transform

absorb | recover
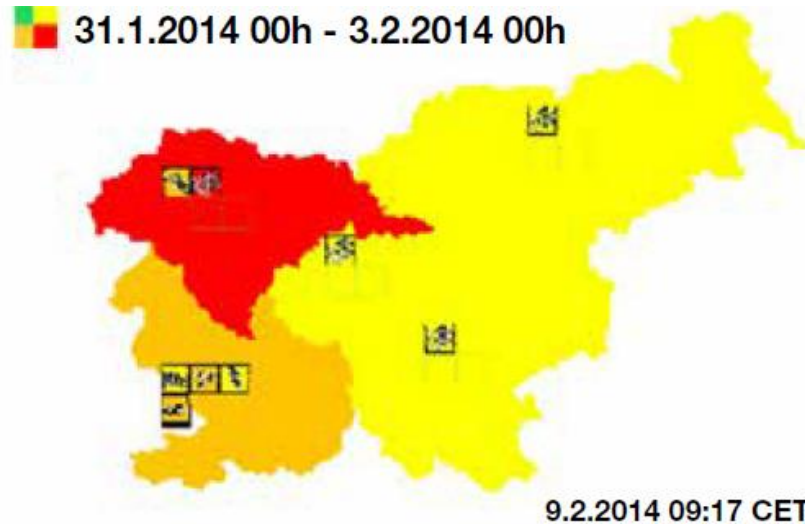
Four essential patterns,
(1) absorbing a shock without collapsing,
(2) recovering from a shock,
(3) System "Kaput" failure

(4)adapting through **self-organization and learning**, and eventually **transforming** into a different system by altering structures, functions and feedback loops.

3

Slovenia Black out February 2014 Icing

- **Storm and heavy rainfall**

- **Immediately frozen on the ground and facilities**

- **Layer of ice several cm thick**

31.1.2014 00h - 3.2.2014 00h

9.2.2014 09:17 CET

2.2.2014 00h - 3.2.2014 ooh (CET)

9.2.2014 09:10 CET

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Slovenia Black out February 2014 Icing

Results

- **250 000 people from 2 mil** 10 days without electricity
- in some location emergency diesel generators provided electricity **for 3 months**
- **1000 km lines damaged estimated damage only to network 70 millions EUR**
- **GSM failed totally**
- **Remote control failed totally**
- **FM signal failed**
- **No information about real situation**

Response

- Emergency restoration structures
- **Cooperation with foreign specialist**
  - **Civil protection**
  - **Fire fighters**
  - **Foreign tech.groups**
  - **Cutters**
  - **Specialist with technical aid**
- **In most affected areas foreign staff exceed local workforce by 500%**

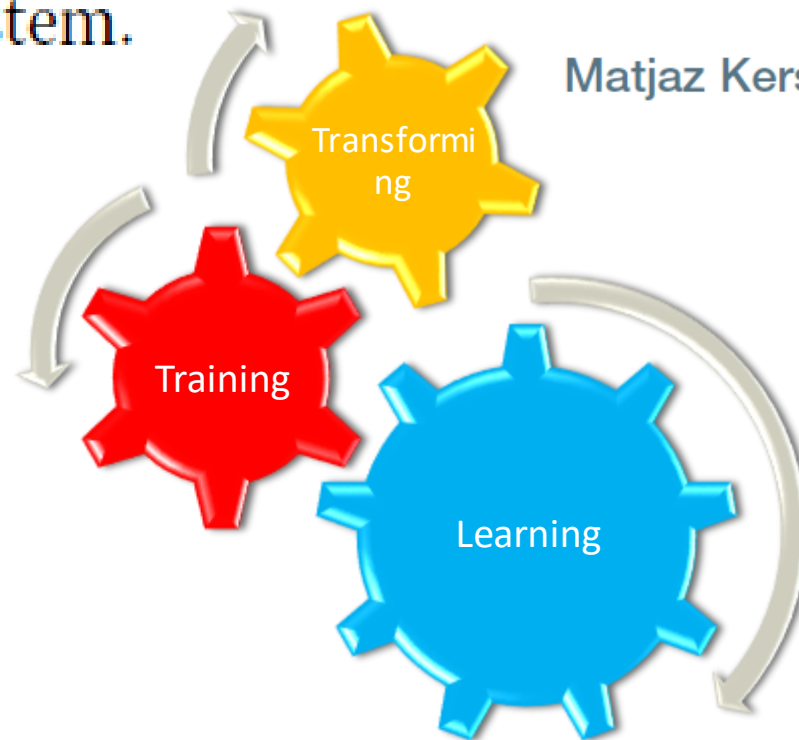**Lesson learned: Need for Improvement and training for :**
Local operation **crisis center operation**, operation of the fleet of vehicles, create and **organize central warehouse**, preparation of **written agreements**, **developed mathods** and content for record keeping in crisis, create **indipendent system** for communication
Coordination and communication of all stakeholders during crisis sitiation, organize **PR communication** during crisis **language barier**

How to ensure adaptive behavior of the CEI system?

A crisis can be made less painful by being prepared for the unexpected and through effective training for a faster restoration of the system.
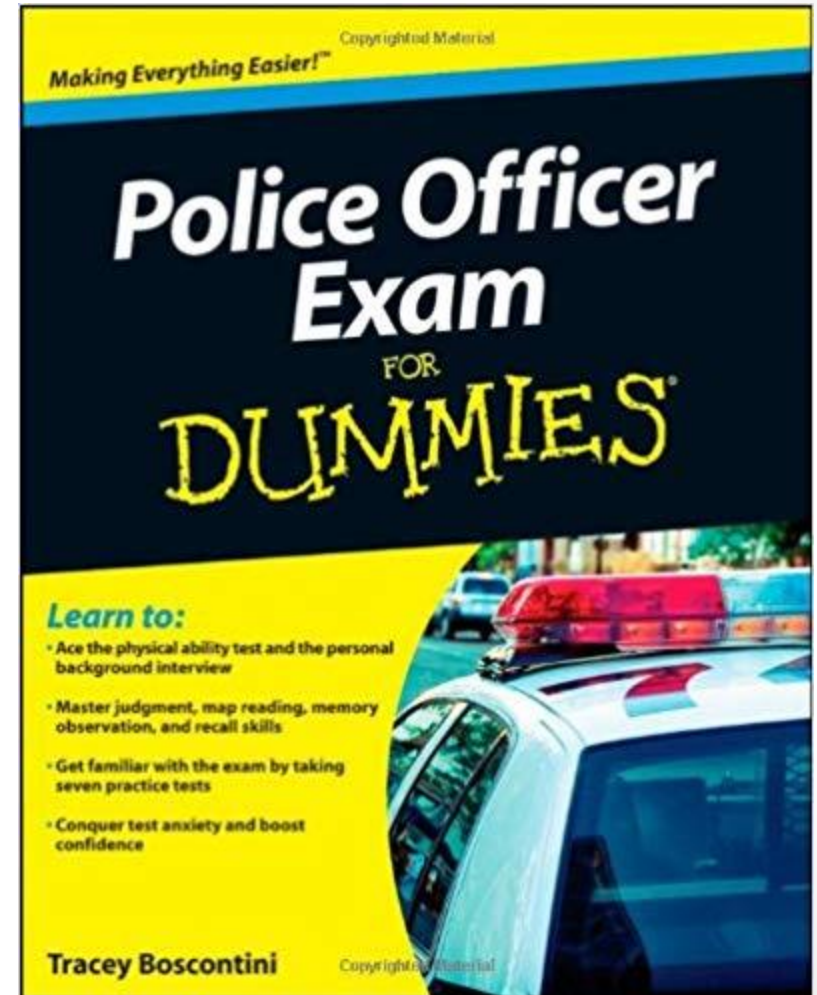
Matjaz Kersnik, Electro Lubliana

Transforming

Training

Learning

6

Target groups for CEI effective training

Operator utility experts

Fire brigade units

Police

Gov. Experts & special groups

Special Army units

Emergency units

Training for Millenials

Training methods depend on complexity of the problem

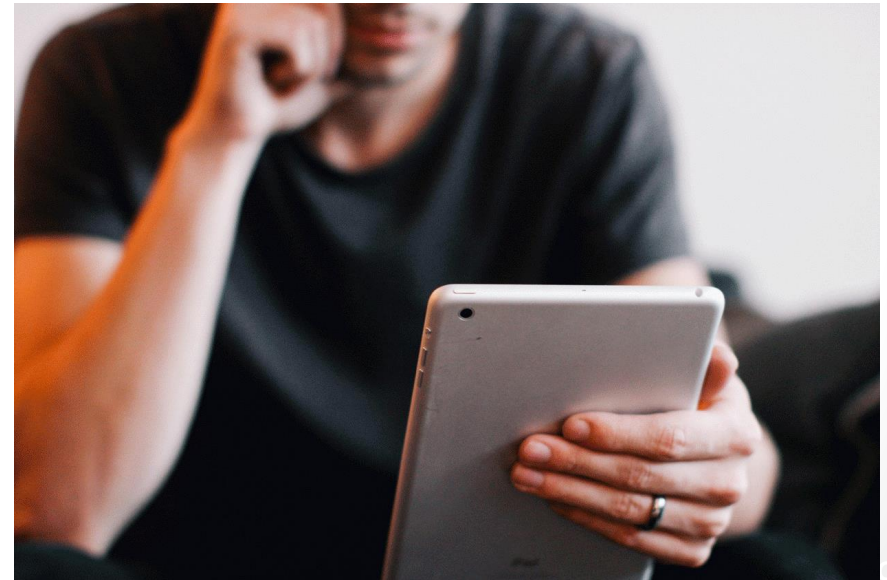- manuals and books

Training for Millenials

Training methods depend on complexity of the problem

- manuals and books

- videos

Protecting Electricity Networks from Natural Hazards

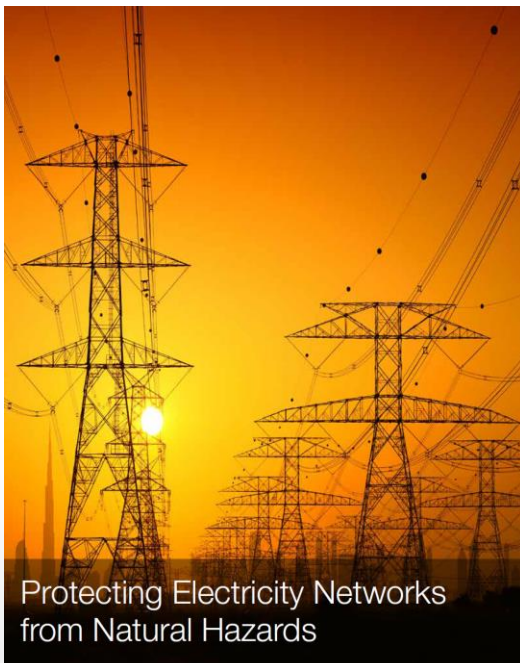OSCE Organization for Security and Co-operation in Europe

Training for Millenials

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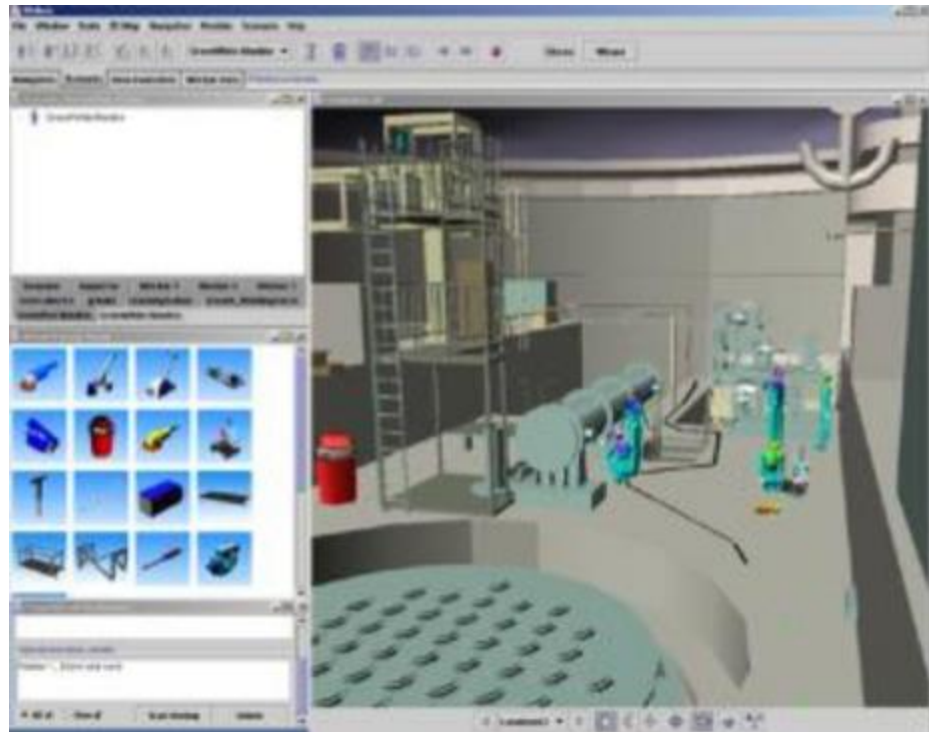
- simulators

Training for Millenials

Training methods depend on complexity of the problem

- manuals and books

- videos

- simulators

-training camps & facilities

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- gamification

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Risk critical events are very complex and expensive

How to make trainings useful and effective?

Reality of Virtual Reality

Training captures key interactions from real life.

Supports not only animated characters but virtual copies of real people (avatars):

- People
- Firemen

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"Much can be learned in play that will afterwards be of use when the circumstances demand it."

Retention

don't only show people how - let them do it themselves thrue games and scenarios
80% retention rate even after a year of training

Personalisation and easy content adaptibility

it's easy to set up personalized processes and follow how each individual progresses

Fun and motivation

people can train according to their own schedules and repeat it
as many times they would like

Didactica Magna
By John Amos Comenius (1592-1671) born in Moravia

Comenius portrait from Rembrandt

VR Training advantage

Easy worldwide access

training can be accessed regardless of time (24/7/365) and place

Scalability

easy to change and improve training schemes

Cost effective

experience real life situations that would otherwise be too dangerous or too expensive to organize

Wide range of supported hardware

smartphones, tablets, computers, smart TV, VR and AR hardware

Training features VR training

- No special place is necessary
- Scenarios

  different scenarios with parallel story lines

- Exploration
- Optional levels of realism (schematic - photoreallistic)
- Point of view

  of the person or any other focus

- Visualization of invisible events

  electro-magnetic fields, projectile tracks, fire water tracks

- Repeat any part of the experience and improve responses

Biofeedback and neurofeedback

BFB and NFB process:

Monitoring:

- Breathing, blood pressure, hearth freq.
  Temperature, EMG, in real time

Evaluation:

- Personal psychological profile
- Stress resilience

Training:

According Personal profile specific training program set up for each trainee

Elimination:

- stress collapses, human failures

Optimization:

- performance and decision process during stress situations

Project : Training facility

Due to complexity of the protection project is divided to 3 phases

1.phase

feasibility study, and analysis for training needs in the region related to CEIP

2. phase

data collection, creating of 3D virtual world, special parts of software , developing scenarios, testing, training in VR, implementing methods BFB & NFB (Biofeedback and Neurofeedback)

3.phase

training facility and training polygon erection
training courses and SW distribution

Thank you for your attention

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