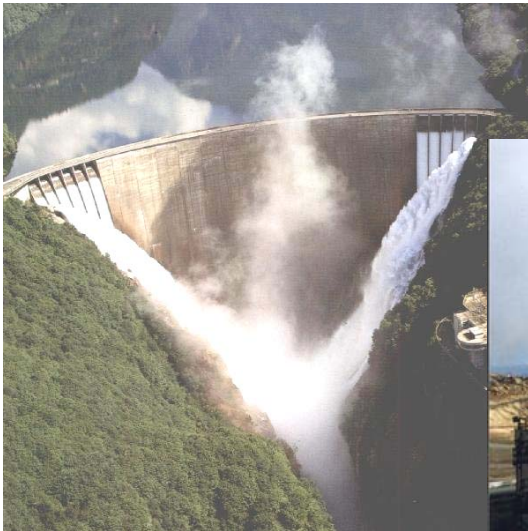




# Electric power supply security and “natural hazard” risks

Franco Romerio and Jean-Jacques Wagner



# PROBLEM

- Electricity supply security (ESS): a challenge for the public and private sector worldwide
- “Natural hazard” risk (NHR), amplified by climate changes: a factor that can jeopardize the ESS
  - Risk management in the electric sector should appropriately integrate NHR
  - In particular, considering the new organisation of the electricity sector (competition)



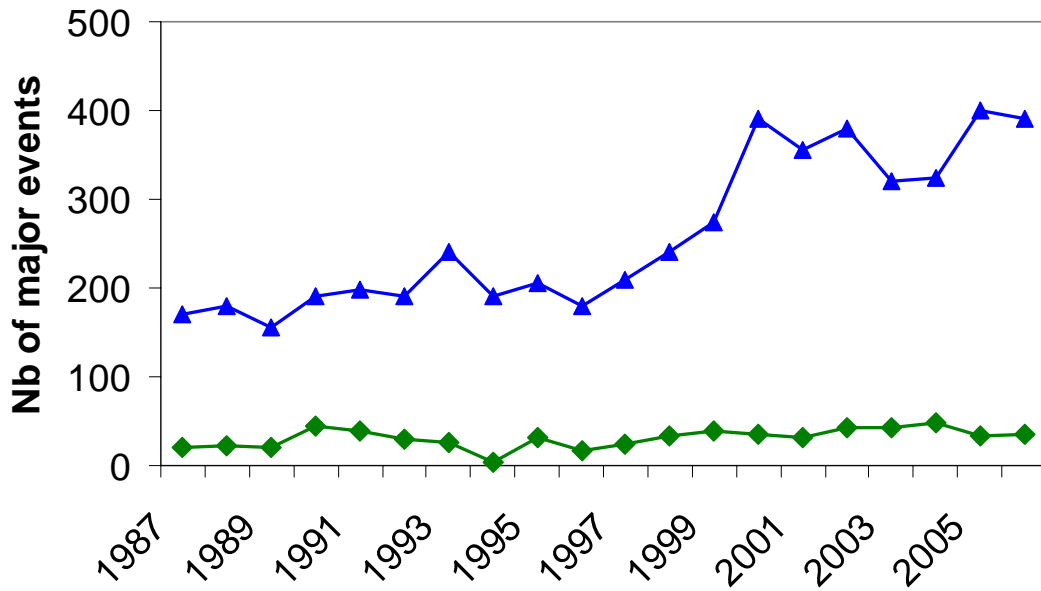
Floods/dam: Switzerland, 1987

Source: AET



Ice storm/lines: Canada, 1998

Source: Swiss-Re

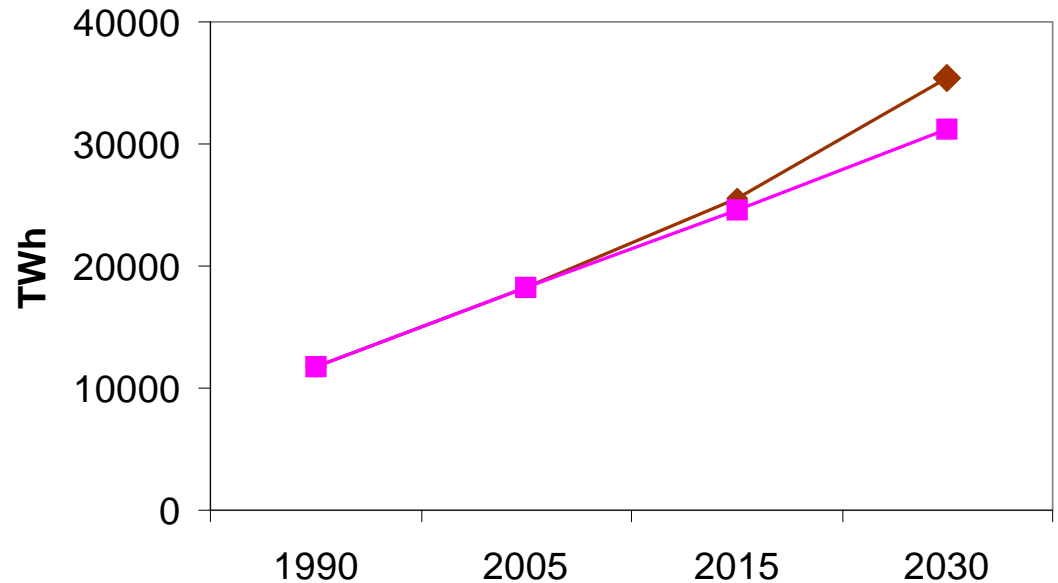


Hydro-meteorological  
versus Geological  
disasters  
WORLD

Source: Hoyois *et al.*, 2007

## Investments of hundreds of billions of EURO at risk

Electricity generation  
Reference and Alternative  
Scenarios  
WORLD



Source: IEA, *World Energy Outlook*, 2007

## Illustration: Lothar & Martin Windstorms, *France, Dec. 26/28 1999*

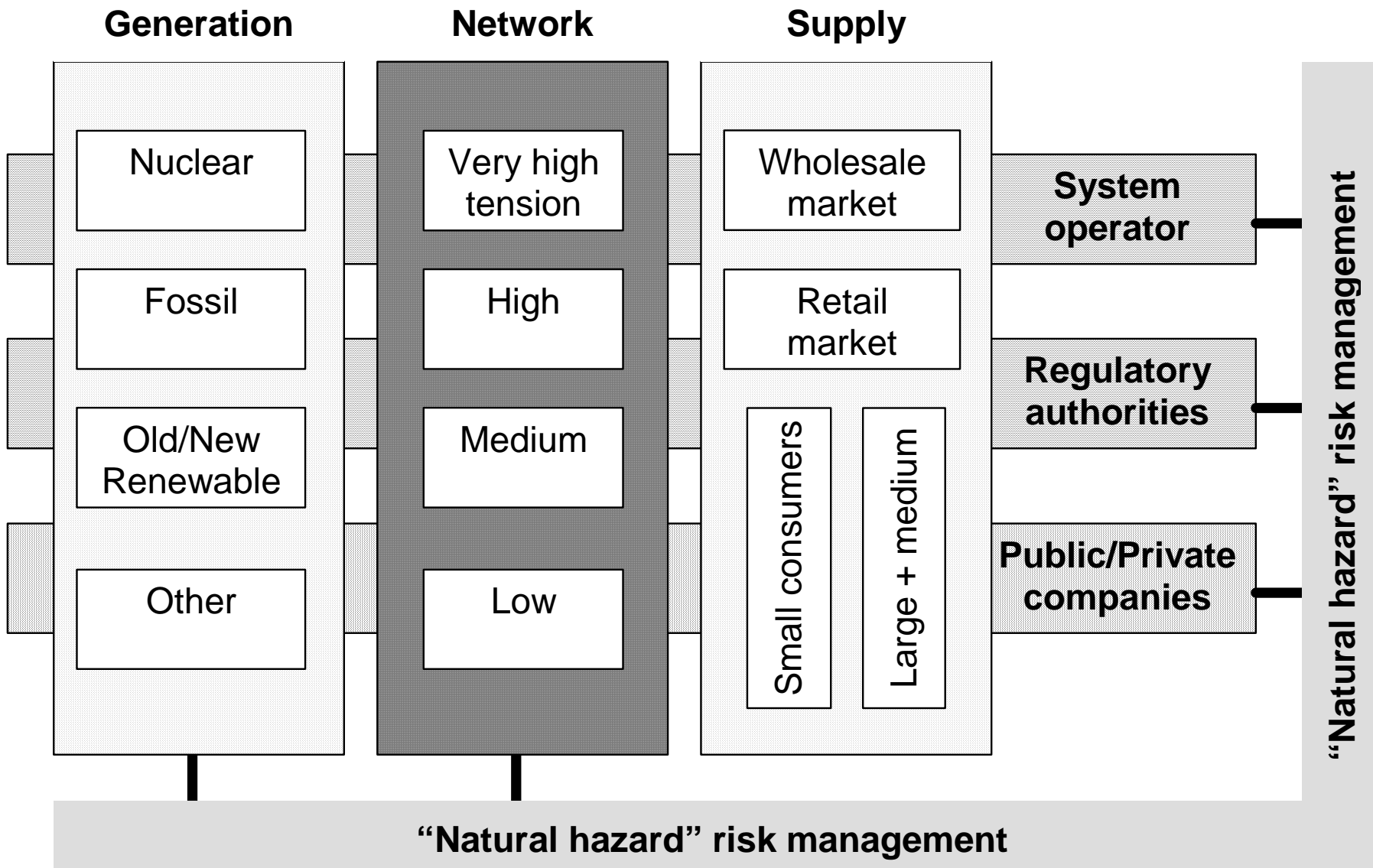
*The greatest devastation to an electricity network ever seen  
in a developed country*

- 280 HT transmission pylons toppled
- 36 HT transmission lines lost
- 3.5 million homes and businesses without power
- 10 million people affected
- Power completely restored only after 20 days
- Electricité de France's losses: EURO 1.5 billion  
(compensations offered included)

**« pylons were not designed to survive wind-speeds above 145 Km/h »**

Source: RMS, *Windstorms Lothar and Martin.*

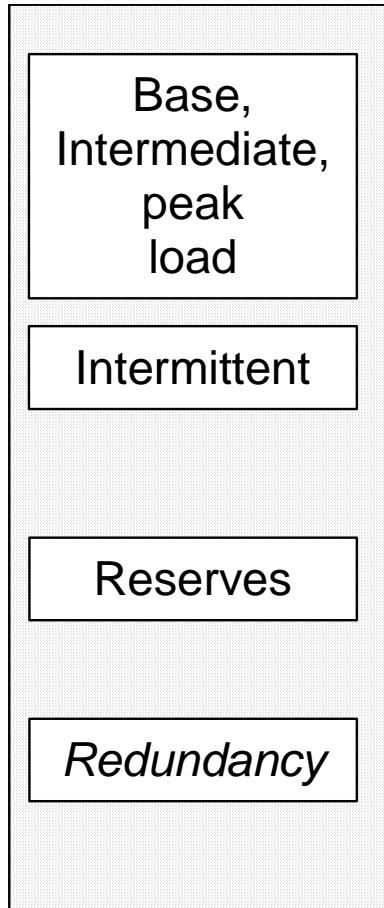
# OVERVIEW



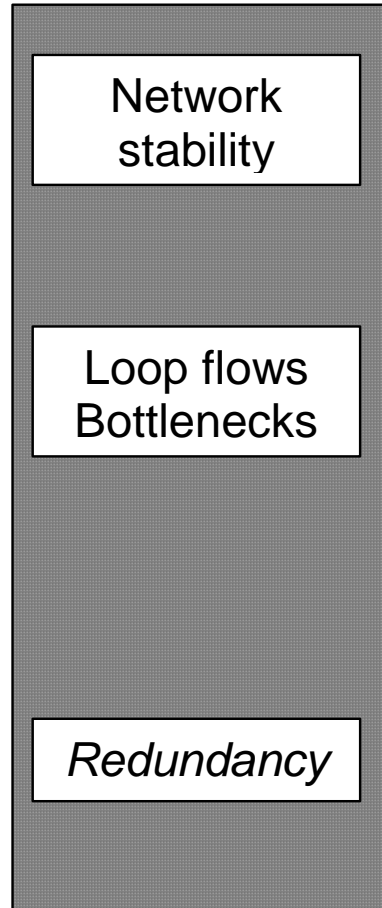
 **Competition**     **Monopoly/Access**     **Regulation**     **Business**

# SUPPLY SECURITY

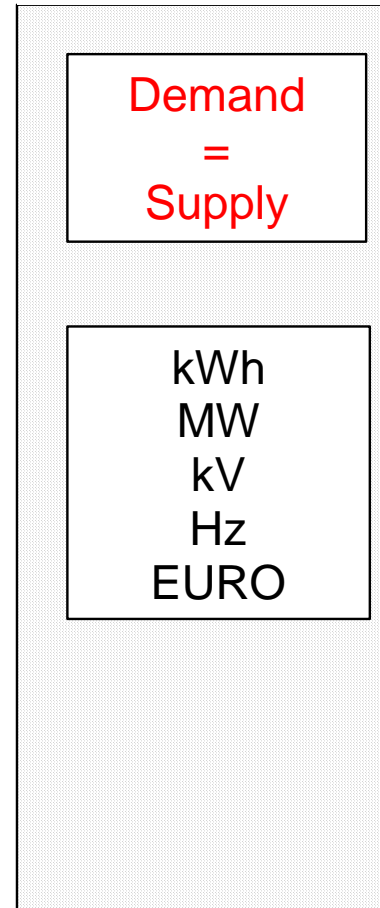
## Generation



## Network



## Supply



 **Competition**

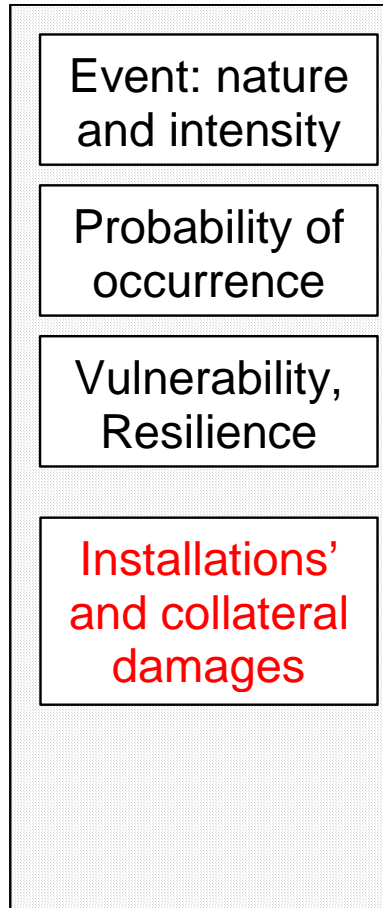
 **Monopoly/Access**

 **Regulation**

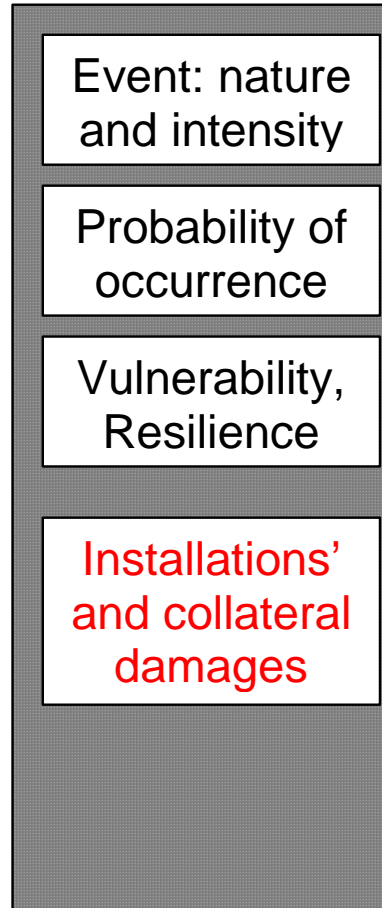
 **Business**

# "NATURAL HAZARD" RISK

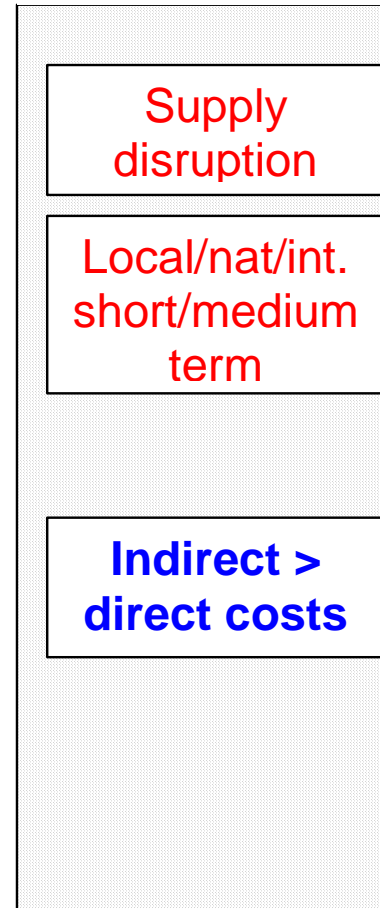
## Generation



## Network



## Supply

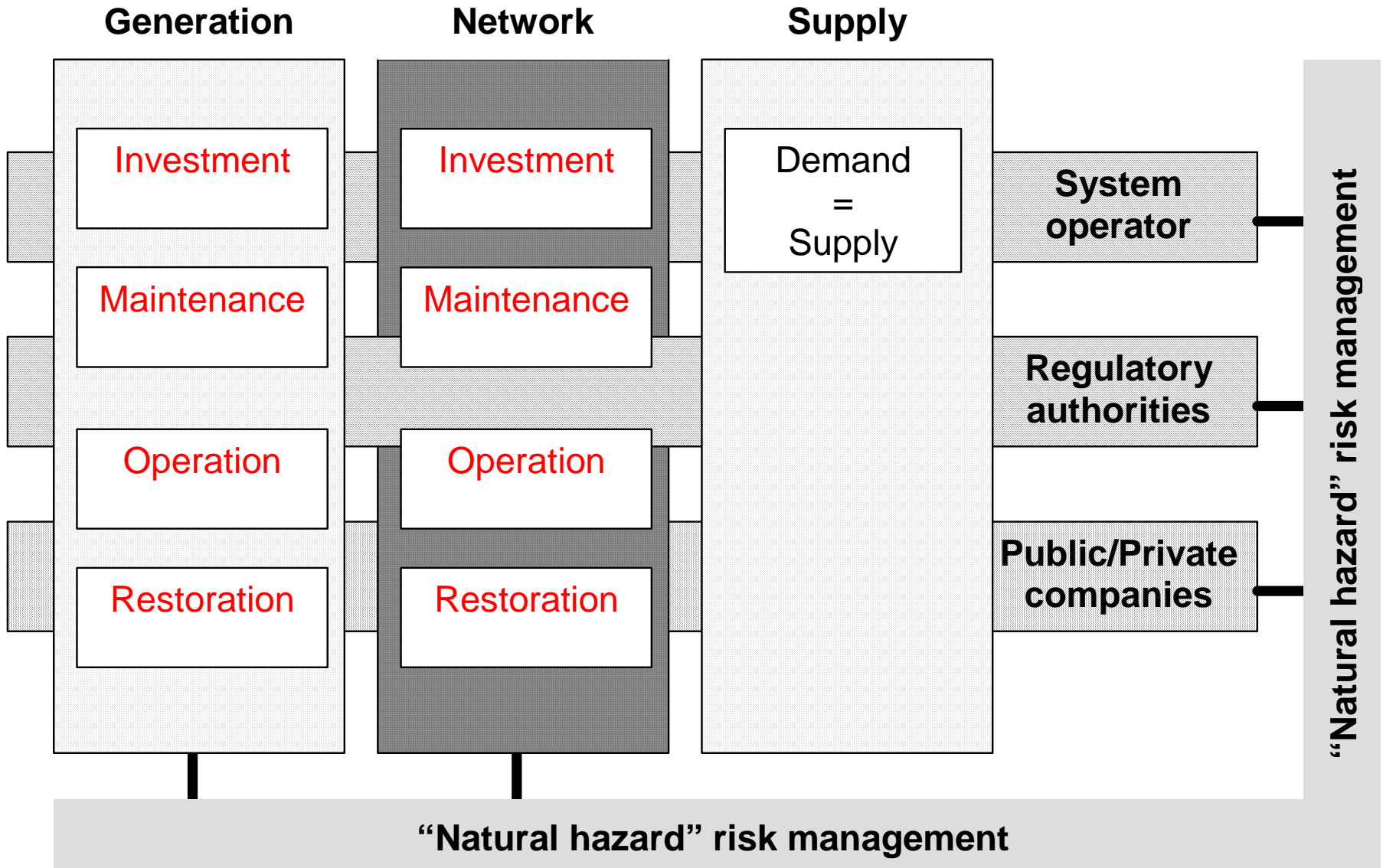


 Competition

 Monopoly/Access



# “NATURAL HAZARD” RISK MANAGEMENT



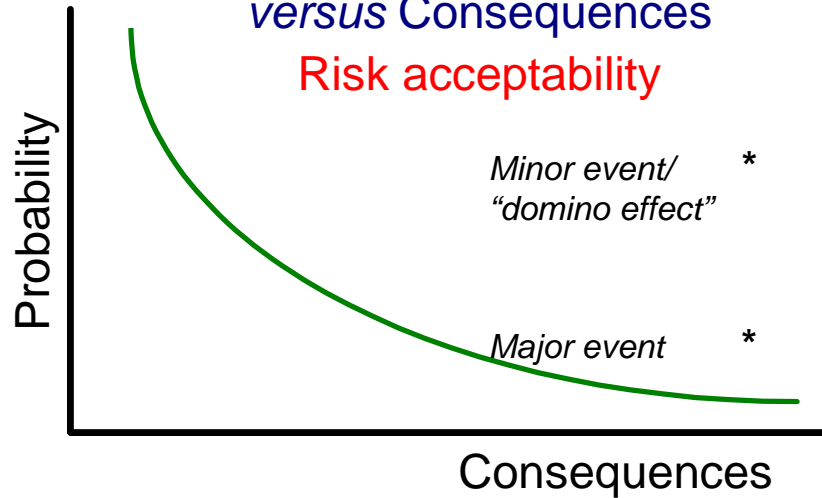
□ Competition    ■ Monopoly/Access    □ Regulation    □ Business



# CRITICAL FACTORS

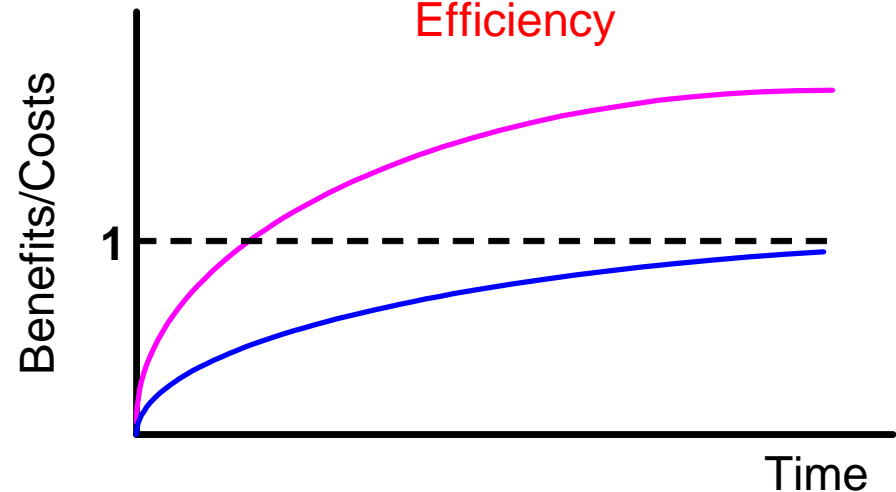
Probability of occurrence  
versus Consequences

Risk acceptability



Expected Costs versus  
Benefits (avoided costs)

Probability of occurrence,  
Rate of discount,  
External costs/benefits,  
Public goods,  
Efficiency



“Natural hazard” risk management

“Natural hazard” risk management

Today “Natural hazard” risk management is far from perfect

# CONCLUSION

- Risk management: a complex problem: impossible
  - To develop “natural hazard” risk management without taking into consideration the electricity reforms
  - To guarantee supply security without dealing with the “natural hazard” risk
- Trade-off between expected costs and benefits: very useful
  - One should be aware that in several cases, high direct and indirect costs may be avoided at a low price



**Blackout, Italy, 28.9.2003**

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