



**ICOLD & APG Symposium
on
Sustainable Development of Dams & River Basins**



The Need for Dam Safety Management Program in Nepal

by

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Outline

1. Resilient Dams for Economic Development and National Prosperity
2. Natural Hazards in Nepal and Potential Dam Safety Risks
3. Dam Incidents and Globally Changing Regulatory Landscape
4. International Best Practices on Dam Safety
5. Robust Dam Safety Management Program for Resilient Hydropower Development



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Dams for Economic Development

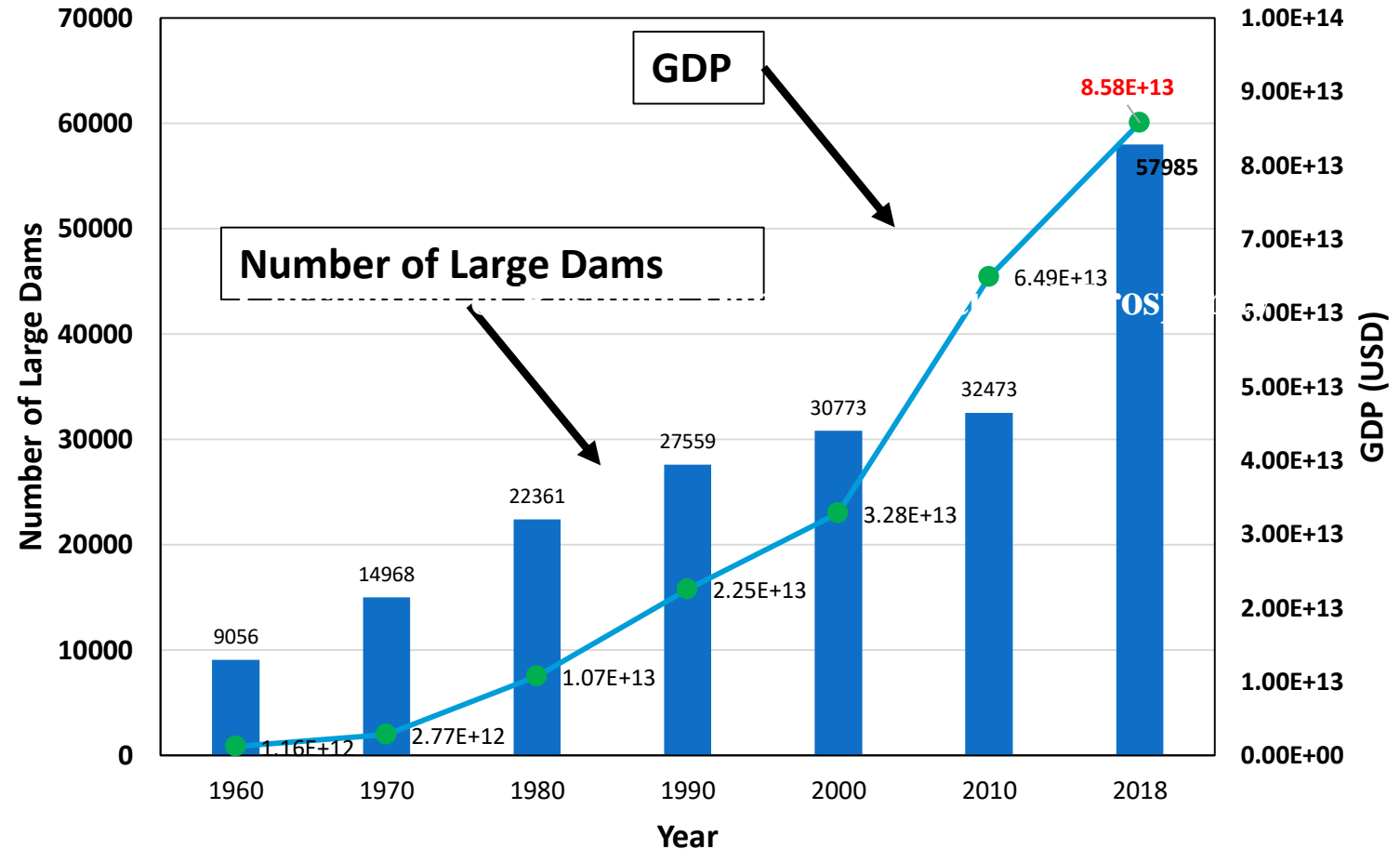
- **Water is Nepal's one of the most precious resources, and dams are necessary for:**
 - **Hydropower - primary driver for dam construction in Nepal**
 - **Dependable water supply**
 - **Irrigation**
 - **Flood control**
 - **Tourism (Recreational opportunity)**
- **Despite benefits, failure of a large dams can pose significant risk to:**
 - **The public; Environment; Cultural heritage**
- **If safely developed and wisely utilized, hydro can be nation's the most powerful economic engine**



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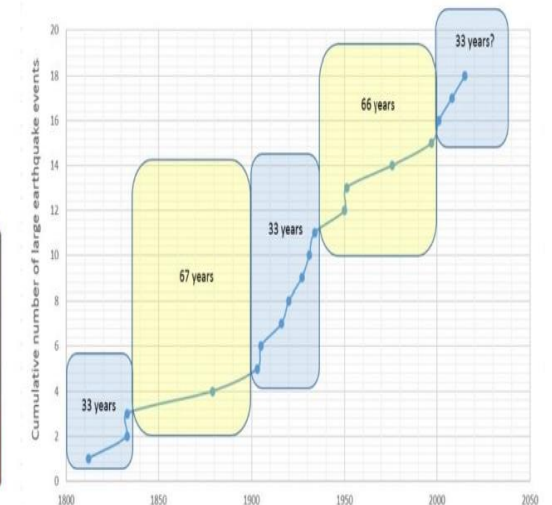
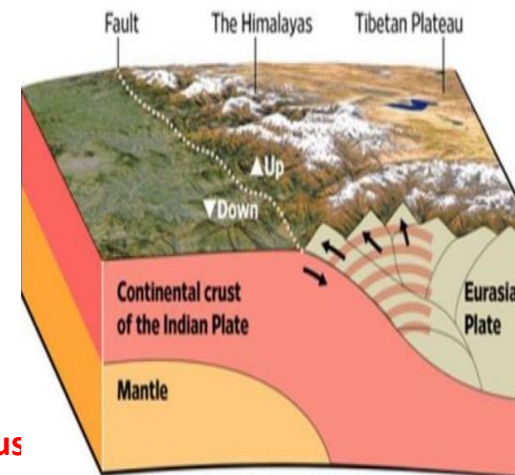
Correlation of Resilient Dams and National Prosperity



Natural Hazards and Dam Safety Risks in Nepal

➤ Dams in Nepal are exposed to many natural hazards

- Earthquakes
- Floods
- Landslides
- Debris Flows
 - Glacial Lake Outburst Floods (GLOF)
 - Landslide Dam Outburst Floods (LDOF)
 - Ice Dam Outburst Floods (IDOF)
 - Rainfall induced debris flows
 - **Combinations – most dangerous**



- Inherent risks of dams can be minimized but cannot be eliminated to zero
- Integrated geo-hazard assessment resilient hydropower development



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Effects of Climate Change on Dam Safety Risks (Global Issue)

Rapidly changing climate in the Himalayan Region Aggravates the Situation Further

- Climate Change is a certainty, the impacts of may be uncertain
 - Increased probability of potential risks
 - Increased potential for intense rainfall
 - More frequent and extreme floods
 - Potential to increase overtopping occurrences
 - Increased landslides, GLOFs, LDOFs
 - Higher temperatures are very likely
 - Melting ice and permafrost de-stabilizes mountain slopes – increasing landslide potential
- Rational approaches to deal with climate changes are slowly emerging
 - Prediction capabilities are currently limited
 - Engineers responses needs to be more reactionary and adaptation oriented
 - One example may be frequent assessment of basin hydrology to track changes



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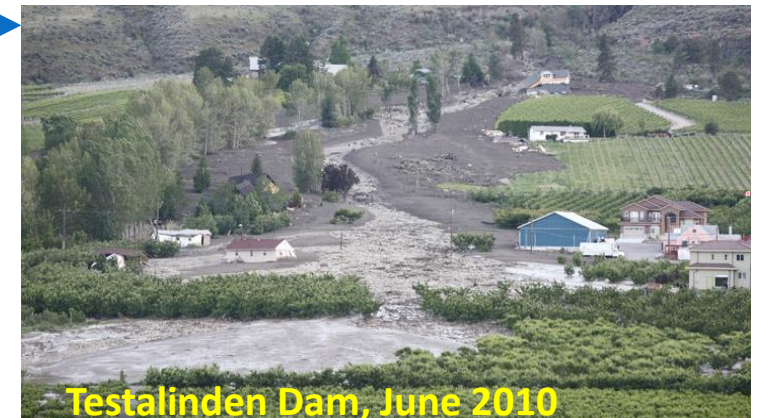


Downstream Impacts of Dam Incidents and Changing Regulatory Landscape (Global Perspective)

- Catastrophic failure of St. Francis Dam (US, 1929)
 - Killed more than 400 people
 - All dams were placed under strict government supervision with jurisdiction over all dams (except federal)
- Devastating Saguenay flood (1996, Canada) →
- Testalinden Dam failure, Canada (2010) →
- Oroville Dam spillway incident (US, 2017)
 - Caused mandatory evacuation of at least 188,000 people
 - Major changes in dam safety practice and FMEA process (ongoing)

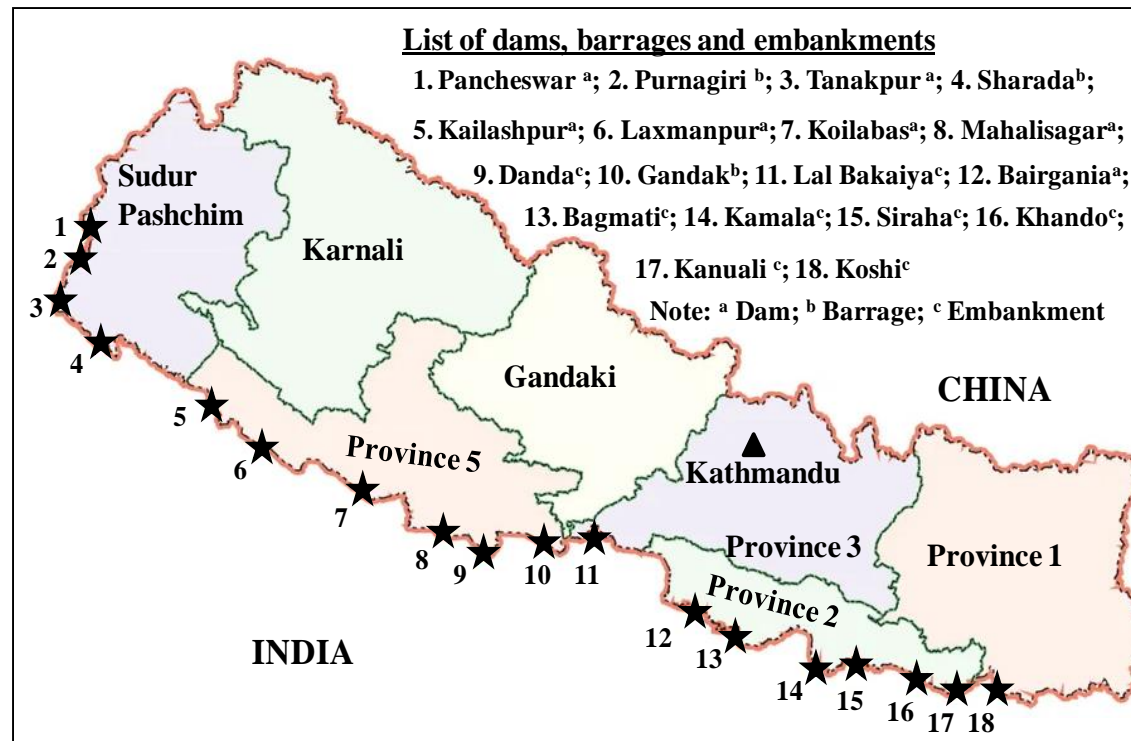


Saguenay flood, 1996



Testalinden Dam, June 2010

Potential Upstream Impact (Transboundary Issues)



- Considerable reservoir surcharge during monsoon impacting people
- Implementation of international best practices for transboundary dams (e.g., Operational rules, information sharing, contract obligations)
- Collaborative emergency preparedness and response plan - both countries
- Adequate consultation of impacted parties during planning and project approval
- Must pay attention and address issues at higher level bilateral meetings



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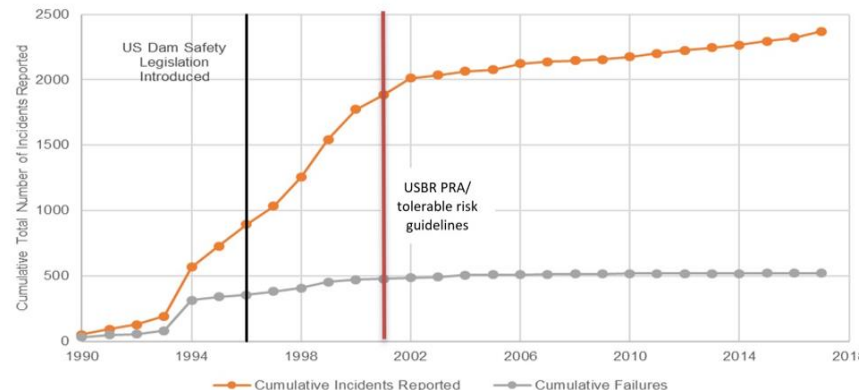


Ongoing Improvements in Dam Safety Practice and Benefits



• Teton Dam failure (USA, 1976) was also a failure for regulatory improvement

- Claimed 11 human lives, destroyed thousands of cattle/homes
- Set stringent regulation in US & demanded for comprehensive dam safety programs
- Since then, ongoing regulatory improvements continue
- Dam safety incidents reduced from about 39/yr to 9/yr within 6 years following the enactment of dam safety legislation in the US (1996)
- Incident curve flattened further once risk concepts were introduced in 2000
- Dam incidents demanded for more robust dam safety management programs to increase public safety and to reduce owner's liabilities



It is our professional and ethical responsibility to educating ourselves, our executives, and our policymakers.



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Examples of International Best Practice on Dam Safety

- Owners need to have a comprehensive understanding of regulatory requirements and Dam Safety Management Program
- An effective Emergency Management Plan is a low-cost risk management tool for dam owners
- Developing and testing an emergency management plan is a key requirement of an effective Dam Safety Management Program
- Level of effort required for Dam Safety Management depends on the consequence classification of dams



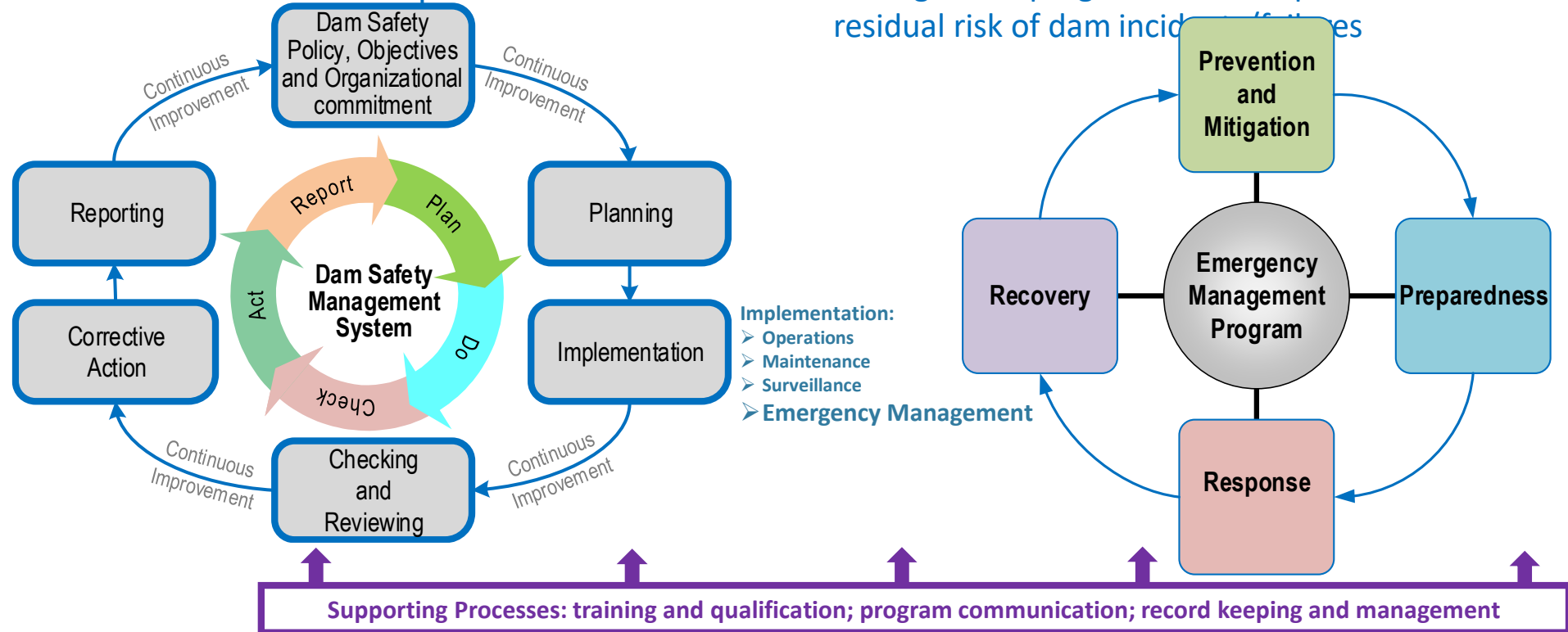
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Well-structured dam safety management program reduces the likelihood of dam safety incidents and its consequences

Effective emergency management plan is an important element of a sound dam safety management program which helps to reduce the residual risk of dam incidents

Robust Dam Safety Management System for Resilient Dams





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Sound Dam Safety Management Program for Resilient Dam Infrastructure

- GoN plans to increase its hydropower generation capacity to:
 - meet the nation's long outstanding energy shortage
 - support the national industrial development
 - export energy to its neighbouring countries for national prosperity
- Many hydropower and water storage dams to be constructed
- National dam safety program tailored to the specific needs of Nepal helps minimize the likelihood and consequence of dam safety incidents
 - Increases the societal and professional confidence that the inherent risks of a large engineered structures are appropriately addressed/managed
 - **Ultimately help to create an attractive investment climate in Nepal for national and international investors on major hydropower projects**



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Thank you

