PLM Implementation at Hydro-Quebec

By Steven E. Weyman, Ing.

Head of Special Projects,
Power Generation Engineering Department
Hydro-Quebec Equipment Division
**Presentation agenda**

1. HQESP Mission and Business Core Overview
2. PLM in Engineering and Construction
3. Key Actors and Paradigms
4. Challenges, Benefits and Lessons Learned
5. Conclusions
1. Mission and Business Core Overview

HQESP is dedicated in engineering and construction activities for hydroelectric energy generation, transportation and access to infrastructures.

HQESP fulfils its mission by providing solutions based on best practices for economic, social and environmental acceptability through partnerships with communities and industry.

HQESP business investments exceed 2 G$ per year.
1. Mission and Business Core Overview (cont'd)

HQESP engineering activities include preliminary and feasibility studies of projects. Detailed engineering for tender and construction was always done by engineering firms.

With PLM implementation, internal activities have been extended to detailed design up to 30%. Engineering firms complete the work to 100%.
2. PLM in Engineering and Construction

PLM implementation at HQESP begins in 2004.

Multidisciplinary mock-up activities:
- Geomatic – Surveying and land modelling
- Geology – Investigations and consolidation
- Geotechnical – Dams, dykes and access roads
- Structures – Reinforced concrete and steel
- Mechanical – Heavy and auxiliary systems
- Electrical – Power systems and controls
- Architectural
- Project estimation and management
2. PLM in Engineering and Construction (cont’d)

Geomatic:

- Topographic contours representation (HQ with DS)
- Land, bedrock and hydrographic representation
- Tools for surface mesh updates
2. PLM in Engineering and Construction (cont'd)

Geology:

- 3D representation of investigations
  
  Bedrock layer depth
  Rock quality
  Fractures and faults planes

- Rock consolidation

- Rock protection
2. PLM in Engineering and Construction (cont'd)

Geotechnical:

- Intelligent propagation of dam sections

- Access roads
2. PLM in Engineering and Construction (cont'd)

Structures:

- Concrete reinforcing steel bars
- Metallic structures
- Parametric models
2. PLM in Engineering and Construction (cont'd)

Mechanical systems:

- Heavy mechanical systems
- Auxiliary mechanical systems

P&ID driven: 2D ←→ 3D

System components specs
2. PLM in Engineering and Construction (cont'd)

Electrical systems:

• Power systems

• Control systems

• Ground network
2. PLM in Engineering and Construction (cont'd)

Architectural:

• Interior spaces

• Building materials

• Building shell
2. PLM in Engineering and Construction (cont'd)

Project management:

- Multidisciplinary integration and conflicts resolution
- Construction methods and sequencing
- Cost estimation
- Change management
3. Key actors and Paradigms
3. Key actors and Paradigms (cont'd)

Evolution of paradigms brought by PLM:

- Multidisciplinary collaboration on a continuous basis
- Anticipation of the whole project lifecycle
- Creation and management of 3D mock-up
- 2D representations from 3D mock-up
- 3D changes traditional project management
- Integration of all information to Model Based Definition
4. Challenges, Benefits and Lessons learned

Challenges:

• Encourage implementation in construction industry
• Integrate relevant and complete information into the 3D:
  - Topological information
  - Technical data and specifications
  - Maintenance requirements
• Develop usage in construction activities
• Rethink work process and contractual terms
• Integrate engineering authentification into the 3D
4. Challenges, Benefits and Lessons learned

Benefits:

• At engineering phase:
  - Usage and adaptation of existing designs
  - Comprehensive multidisciplinary integration
  - Database for normalized components
  - Knowledge database legacy
  - Relatively fast adjustments in design strategy

• At construction phase:
  - Eliminate / minimize clashes during construction
  - Increased understanding of complex tasks
  - Accurate planning and estimation of quantities
  - Direct interface with fabrication activities
4. Challenges, Benefits and Lessons learned

Lessons learned:

• Investments are capital intensive
• Learning curve requires time, money and resources
• Benefits related to construction difficult to quantify
• Favor continuity in labour force from project to project
• Preserve 3D know-how with more projects in the pipeline
• Assess benefits vs cost and operability in 3D development
5. Conclusions

- PLM implementation introduces new paradigms
- Construction industry stakeholders are challenged
- Opportunities for competitiveness in industry
- Benefits and savings are worth the efforts
- Legacy drawn by PLM ensures know-how perennity
Thank you...