Getting started:
Environmental Impact Assessment (EIA)

For the Linear Collider (LC) Project

Goal:
To provide information on the EIA process and the criteria that will be needed to be evaluated for the next LC.

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30th August 2011

Introduction

Who am I?

- Caroline Waaijer
- Summer Student for John Osborne
- From Amsterdam, Netherlands
  - Master student in Hydrology
- Exchange year at EPFL, Lausanne, Switzerland
  - Environmental engineering courses

EIA start-up manual will be available on EDMS.

Overview talk

Introduction to the Linear Collider Project

EIA

- What is it?
- Do we need to do it?
- What is the EIA Process?

Impact criteria

- Biophysical, socio-cultural, socio-economical
- Special focus on energy, water, landscaping, social acceptance (including radiation, construction issues)

Conclusions

Next steps

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THE LINEAR COLLIDER PROJECT [1/3]

The project:

- high energy and precision machine
- complementing LHC

Two candidates:

- CLIC
- ILC

Parameters:

Parameters	CLIC		ILC	
	500 GeV	3 TeV	500 GeV	1 TeV
Length (km)	13.74	49.28	29.50	~52
Internal diameter Main Linac (m)	5.6	5.6	Region dependent	Region dependent
Power (MW)	245	565	230	..
Cooling water (m^3/year) for an average operation year of 200 days	$2.64 * 10^6$	$6.72 * 10^6$	…	…

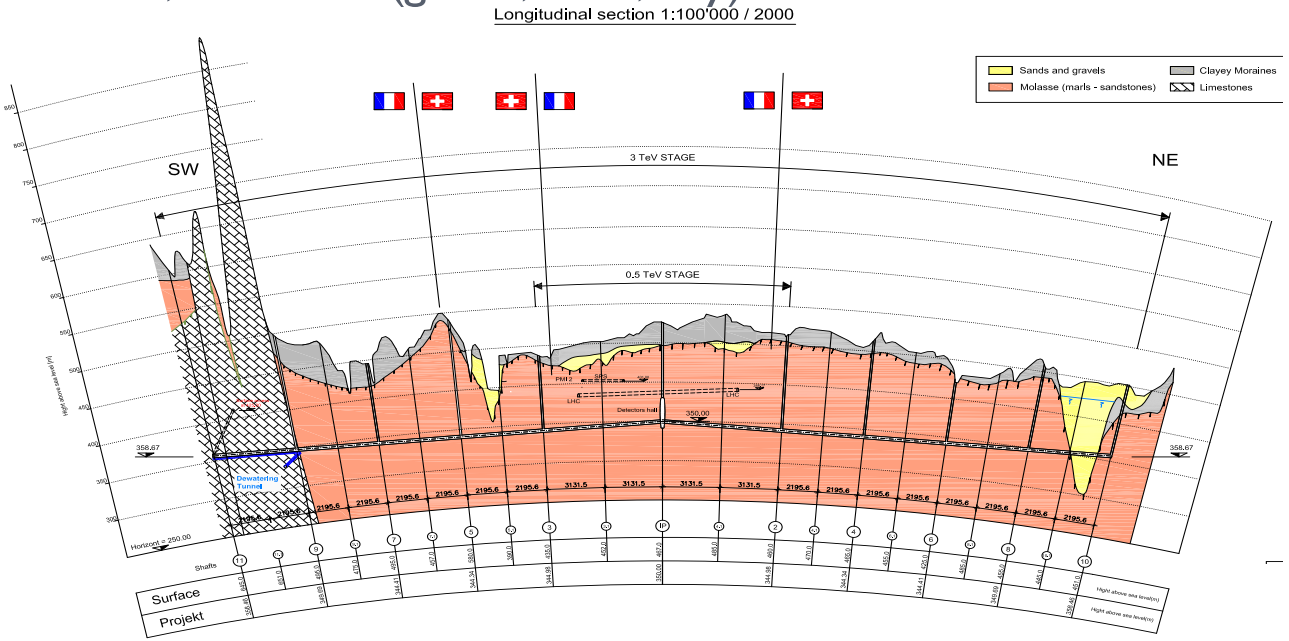
THE LINEAR COLLIDER PROJECT [2/3]

Location:

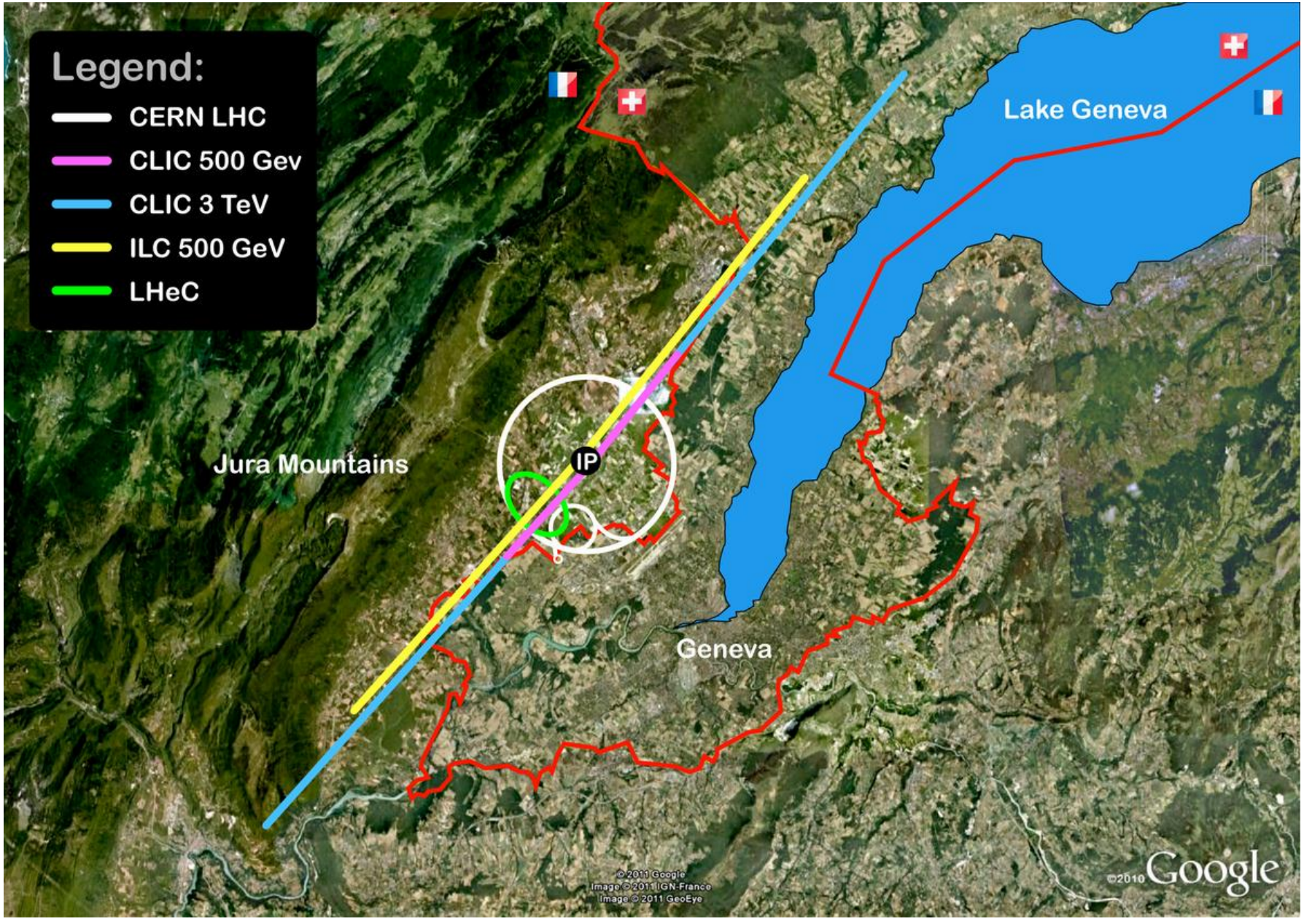
- on and near existing CERN land
- in the Geneva Molasse basin
- parallel to Jura mountain chain

Geology:

- Limestones, Molasse rocks, Moraines (gravel, sand, clay)



THE LINEAR COLLIDER PROJECT [3/3]



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EIA [1/2]

What is it?

- "A purpose of an EIA is to improve decision-making and to ensure that project options under consideration are environmentally sound and sustainable".

- World Bank, 1999

'People, planet, profit' (3 P's)

- Measures an organization's success in social (people), ecological (planet) and economical (profit) values.
- Guarantees a corporate social responsibility
- Underlines the goal of sustainability

EIA [2/2]

Key objectives EIA:

- Establish environmental, socio-cultural and socio-economical initial status of project area
- Identify opinions and policies of actors and stakeholders
- Identify potential impacts
- Establish if these impacts are within permitted limits
- Ensure appropriate mitigation measures are implemented
- Ensure positive effects are maximized by good practice
- Ensure an adequate monitoring plan is developed
- Improve the environmental design of the project

EIA process

How to apply an EIA?

- Three main phases:
  - Screening
    - ✓ Establish necessity for EIA
  - Scoping
    - Conduct EIA
      - ✓ Applied to ≥ 2 alternatives
  - Review
    - ✓ Check before submission

Required Knowledge:

- Multi-disciplinary
  - Juridical
  - Political / decision- making
  - Previous EIA studies
  - Engineering
  - Different environmental disciplines

EIA process: Screening

Does the LC project require an EIA?

YES

- French law:
  - ✓ Environmental Code: Article R 122-8I
  - ✓ Decree nr: 77-1141, October 12th 1977
- Swiss federal law:
  - ✓ Ordonnance relative à l'étude de l'impact sur l'environnement (OEIE)
- EU:
  - ✓ Directive 85/337/EEC
  - ✓ Updated in 1997 (directive 97/11/EC), 2003 (directive 2003/35/EC), 2009 (directive 2009/31/EC)

EIA → Feasibility

EIA process: Scoping [1/6]

1. Reconnaissance / preliminary studies

What information is required?

- Legal framework
  - ✓ French and Swiss laws and regulations
  - ✓ Previous experiences (LEP, LHC, CEVA, CERN tram)
- Policies and decision-making
  - ✓ Local / regional
  - ✓ Stakeholders and decision-making process
  - ✓ Actors

EIA process: Scoping [2/6]

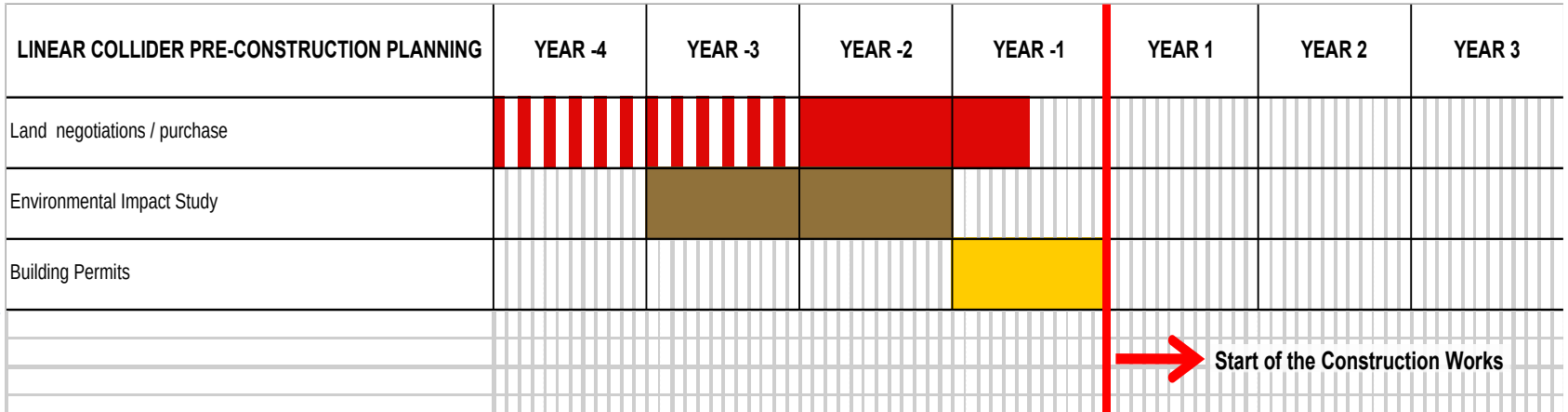
What information is required?

- Project aspects
  - ✓ Scope, alternatives, needs, functioning, value
- Engineering aspects
  - ✓ Implementation phases
    1. Preparation
    2. Construction
    3. Operation & Maintenance
    4. Decommissioning
  - ✓ Site constructions and activities
    - Environmental criteria

EIA process: Scoping [3/6]

What information is required?

- Planning
  - In EIA report
    - ✓ Implementation phases of constructions
    - ✓ Environmental Management Plan (EMP) for each phase
  - For EIA's next phases
    - ✓ Land acquirement
    - ✓ External consultants
    - ✓ Costing
    - ✓ Public debate → review



EIA process: Scoping [4/6]

Public participation

- Required by law
- Start early

I - La réalisation d'aménagements, d'ouvrages ou de travaux exécutés par des personnes publiques ou privées est précédée d'une enquête publique soumise aux prescriptions du présent chapitre, lorsqu'en raison de leur nature, de leur consistance ou du caractère des zones concernées, ces opérations sont susceptibles d'affecter l'environnement. I

Methods:

- One-way
  - Provide information
    - ✓ flyers, information sessions etc
- Two-way
  - Discussion sessions with locals

EIA process: Scoping [5/6]

PICTURES

CERN

Environmental Impact Study

CERN is developing an advanced particle accelerator, which will explore in more detail fundamental particle physics. This will answer questions about the universe.

An Environmental Impact Study will be conducted to minimize possible environmental impacts related to these activities and to optimize CERN's Environmental Management Policy. With this study CERN will commit to:

Ensuring the level of environmental safety and protection specified by European Directives and Standards.

Measuring continuously the parameters defining the environmental impact criteria, such as atmospheric emissions, energy consumption, radiation, water & soil quality and waste generation.

Integrating pollution prevention, risk management, conservation of resources and waste reduction into existing and planned activities in order to minimize their environmental impact.

Monitoring continuously all the parameters defining the environmental impact criteria, agreed with the Host States authorities.

www.cern.ch

What will it do?

The Linear Collider Accelerator is the next step in exploring and unraveling the mysteries of the Universe.
The machine will accelerate two oppositely-directed beams of electrons and positrons in a straight line at high energy and smash them together in head-on collisions.
The Accelerator will be a precision machine, complementing the existing LHC discovery machine. It will explore in more detail the new physics discovered at the LHC, to test current theories and evolve new ideas.

Where will it be?

The Linear Collider Accelerator will straddle the Swiss and French border between the villages Gland (CH) and Bellegarde-sur-Valserine (Fr).
The particles interaction-point will be housed on existing CERN territory in France.
The machine will be located in a tunnel at a depth of 100-150m, mostly in the Molasse Basin and to a small extend in the Jura Mountain chain.

Why an Environmental Impact Study?

To meet international environmental standards CERN will conduct an environmental impact study for the Linear Collider Project. With this study CERN will commit itself to ensure a sustainable development and to minimize the negative environmental impacts due to its activities. It will do so in collaboration with French and Swiss authorities. The main goals of the study will be to:

- Establish the biophysical, social and economical status of the project area
- Identify potential impacts due to activities related to the Linear Collider Project
- Establish if these impacts are within permitted limits
- Develop an appropriate negative impacts mitigation plan
- Develop a positive effects maximization plan
- Set up a monitoring plan
- Integrate public participation
- Informing the public and authorities of the plans and results

EIA process: Scoping [6/6]

2. Assessment & Plan development

- Assessment of:
  - Status quo (zero-point)
  - Effects of project

- Planning of
  - Mitigation negative effects
  - Maximization positive effects
  - Monitoring
  - Reviewing

} Environmental Management Plan (EMP)

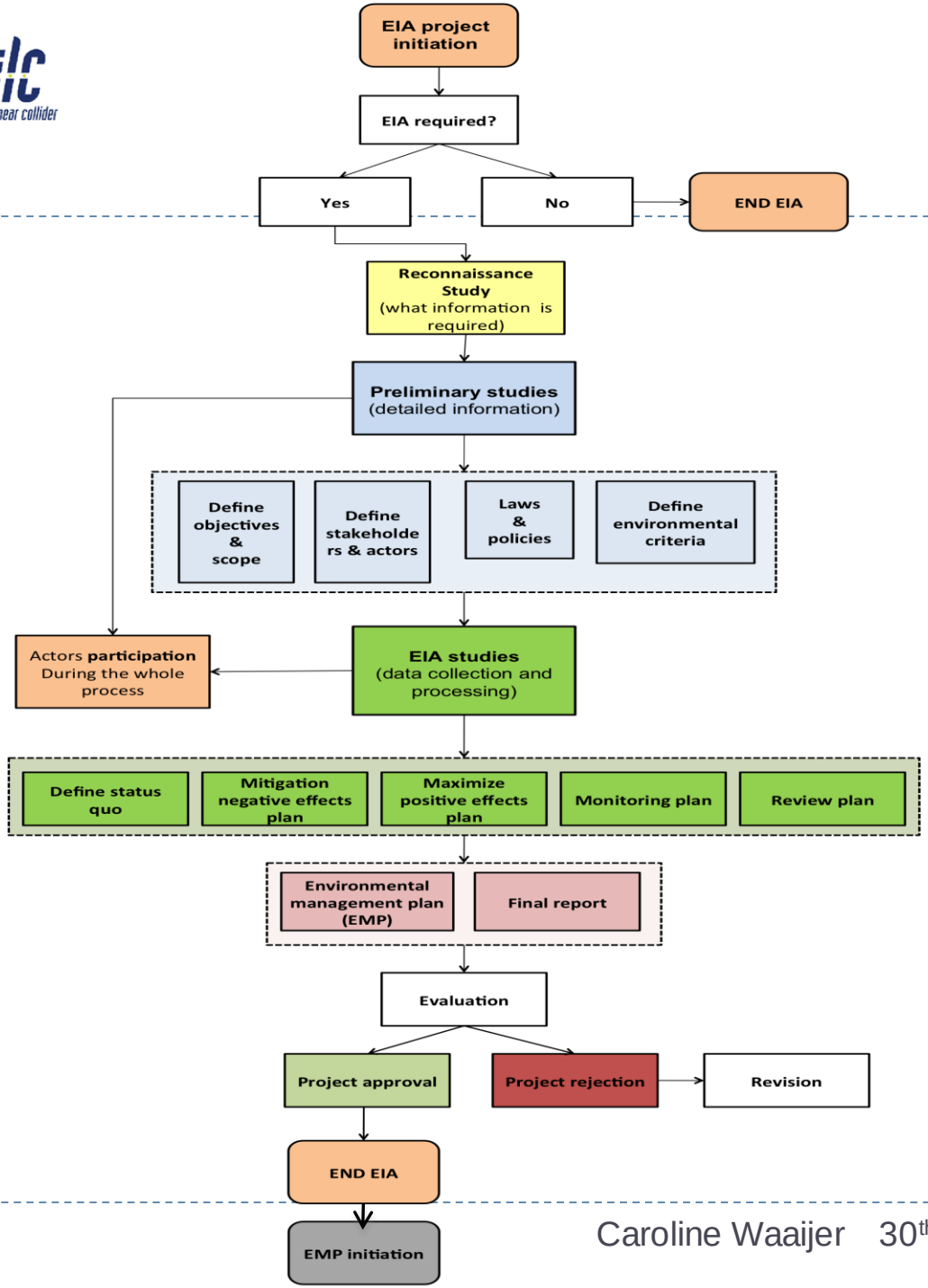
EIA process: Review

Final report

- Content
  - Non technical summary
  - Background and framework project
  - Necessity EIA
  - Status quo
  - Measurements
  - Measures
  - Conclusions
  - Annexes

- Evaluation
  - Approval
  - Rejection

EIA process: Summary



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Impact criteria [1/10]

Environmental criteria

Remember the 3P's?

- Biophysical
- Socio-cultural
- Socio-economical

Impact criteria [2/10]

Classification

Category of Impact	Nature of Impact
Type	Biophysical / Socio-cultural / Socio-economical
Nature	Direct / Indirect / Cumulative…
Severity	Low / Moderate / High
Extent	Local / Regional / Trans-boundary
Timing	Short term / Long term
Duration	Temporary / Permanent
Uncertainty	Low probability / High probability
Reversibility	Reversible / Irreversible
Significance	Unimportant / Important

Impact criteria [3/10]

Impact types:

Type		
Biophysical	Socio-cultural	Socio-economical
Climate & meteorology	Heritage	Employment
Geology & soil	Demography	Demography
Hydrology	Traffic	….
Landscape	Landscape	
Ecology	Health	
Air quality	Safety	
Noise	Noise	
Vibrations	Acceptance	
Radiation		
Energy		
Waste		
Hazards		

Impact criteria [4/10]

Impact matrix:

- Visualize expected environmental impacts in every implementation phase
  - Example on next slide

Impact criteria [5/10]

		Air	Water	Soil	Energy	Visual	Economy	Acceptance	Health
Phase 1	Preparation terrain	x		x		x	x	x	
	Location			x				x	
	Layout							x	x
Phase 2	Civil works	x	x	x	x	x	x	x	x
	Site services	x	x	x	x	x	x	x	x
	Transporta-tion	x				x	x	x	x
Phase 3	Accidents	x	x	x		x	x	x	x
	Site services (e.g. waste)	x	x	x			x	x	x
	Operation machine	x	x	x	x	x	x	x	x
Phase 4	Conditioning terrain	x	x	x		x			
	Dismantling actions	x	x	x		x		x	

Impact criteria [6/10]

Major issues for LC project:

- Civil construction
- Energy
- Water
- Social acceptance
- Waste
- Radiation

Feasibility threat

Impact criteria [7/10]

Civil construction issues:

- Excavation → spoil dumps
- Transportation infrastructure
- Release of pollutants
  - ammonia leakage (LEP)
  - cement, sand, clay discharge to river (LEP)
- Existing geothermal drillings
- Visual impact
  - Surface buildings
  - Power plant
  - Power cables
  - Etc..

Impact criteria [8/10]

Energy consumption

- 500 GeV: 230-245 MW
- Currently:
  - LHC: 120 MW (180 MW at peak)
  - CERN: 230 MW
  - Canton of Geneva: 1.3 GW
  - Swiss power plants:
    - Beznau 1: 365 MW
    - Mühlenberg: 355 MW
- Amount of Energy CLIC will need ≈ small power plant
- Focus on renewable and sustainable energy development
  - Should be studied by experts
  - Only possible when layout project is known in more details

Impact criteria [9/10]

Water consumption

- Estimates for make-up cooling water:
  - 500 GeV: 550 m^3/h → 2.64 million m^3/year
  - 3 TeV: 1400 m^3/h → 6.72 million m^3/year
- Water consumption CERN today: 6 million m^3/year
- To be taken from Lake Geneva, discharged into Rhone river (still unclear)
  - ~ 40 % evaporates from cooling towers
  - ~ 60% rejected

  } Rough estimate
- Focus on renewable and sustainable water use
  - Heat recovery
    - Only possible when layout project is determined
    - Should be studied by experts

Impact criteria [10/10]

Social acceptance

- Major feasibility issue
- Problem areas:
  - Visual impact of constructions
  - Impacts during construction (vibration, traffic, noise, pollutants)
  - Impacts after construction (energy consumption, radiation, Pollutants, noise, traffic etc.)
- Legal battles → avoid as much as possible by public participation.

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EIA Process

- Necessary to perform → feasibility issue
- Complicated: multi-disciplinary and iterative
- Communication is important (stakeholders and actors)
- Inform public & public participation
- Study EIA examples (LEP, LHC, CEVA etc)
- Should start soon
- Cooperation between different GS groups necessary (SE, EN, CV, etc)

Impact criteria

- Civil engineering important part in it
- Focus on renewable and sustainable development water & energy consumption
- Detailed project development necessary
- Internal and external experts needed

Next steps

Completion of start-up manual

- Continued collaboration between CLIC-ILC
- Applicable to other new projects (LHeC, Beta-beams etc)

Planning

- Task division
- Cost estimates for EIA
- Land acquirement

Start

- Working with French and Swiss authorities on EIA
- Informing & stimulating public debate
  - Feasibility issue: EIA must be taken seriously

EIA report

- Start in-depth studies
- Identification knowledge gaps
- Address major issues, especially civil construction, energy, water, social acceptance

Acknowledgements

- John Osborne (GS-SE)
- Sonja Kleiner (GS-SEE)
- Maria Rita Galan Espinosa (GS-SEE)
- Bernard Jeanneret (BE-ABP)
- Mauro Nonis (EN-CV)
- Katy Foraz (EN-MPF)
- Erik van der Kraaij (PH-LCD)
- Jochem Snuverink (BE-ABP)
- Gabriel Ybeles Smith (PH-UAT)

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