DESIGN PROJECT 2026

Meeting: 2 December 2025

Pierre-Yves Gilliéron, SIE Deputy Head

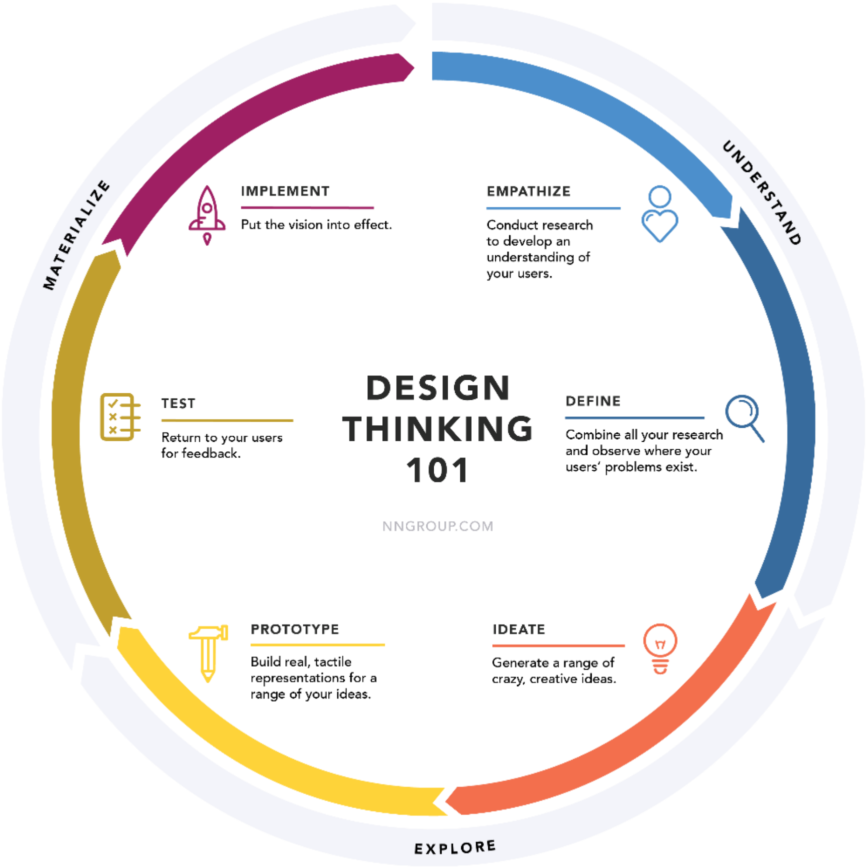
Christina Treier, SIE Administrator

EPFL

EPFL-Section des Sciences et Ingénierie de l'Environnement

Agenda

- Goals
- Skills
- Design thinking
- Work Organization
- Agreement, Budget
- Starting the DP
- Report & Presentation
- Important Dates



Context and Goals

- The aim of the design project is to apply your knowledge in a professional work context.
- A team of students will work as a consultancy company
  - Customer: company, administration
  - Mandate: context, objectives, problem to be solved, expectations
  - Salary: evaluation of your work (grade, ECTS); learning outcomes
  - Responsibility: project management (meetings); searching for information/data; communication; deadlines

Overall Skills

- Using your knowledge in basic sciences and engineering within the context of a real project
- Understanding of a problem
- Defining the needs
- Developing a methodology
- Designing scenarios
- Leading a project and assessing solutions
- Working in a team

Specific & Transversal Skills

- Identify, express and solve an engineering issue
  - Defining the project and writing a detailed proposal
  - Analyzing the different and potential options
  - Choosing the best option according to technical constraints and several characteristics
  - Solving a practical engineering issue
- Manage the different steps of the projects
- Communicate in an efficient way: proposal, report, oral presentation
- Work in a team and with a partner

Design Thinking Project

- Empathize : understand users' needs, thoughts, and feelings through observation and research
- Define : clearly state the problem based on user needs
- Ideate: brainstorm a wide range of potential solutions
- Prototype : build tangible versions of the potential solutions
- Test : get feedback and use it to refine the solution

Main Milestones of DP

- Identification of the topic and clarification of the problem to be solved
- Organization of the DP
  - Meetings, project proposal, definition of the tasks & planning
- The project proposal must be approved by the partner and by EPFL
- Main tasks
  - Work approach, methodology
  - Collect basic data and information
  - Bibliography and references
  - Development of scenarios/options
  - Presentation of selected options
  - Development of a prototype
  - Solutions assessment
- Communication of outcomes

Work Organization

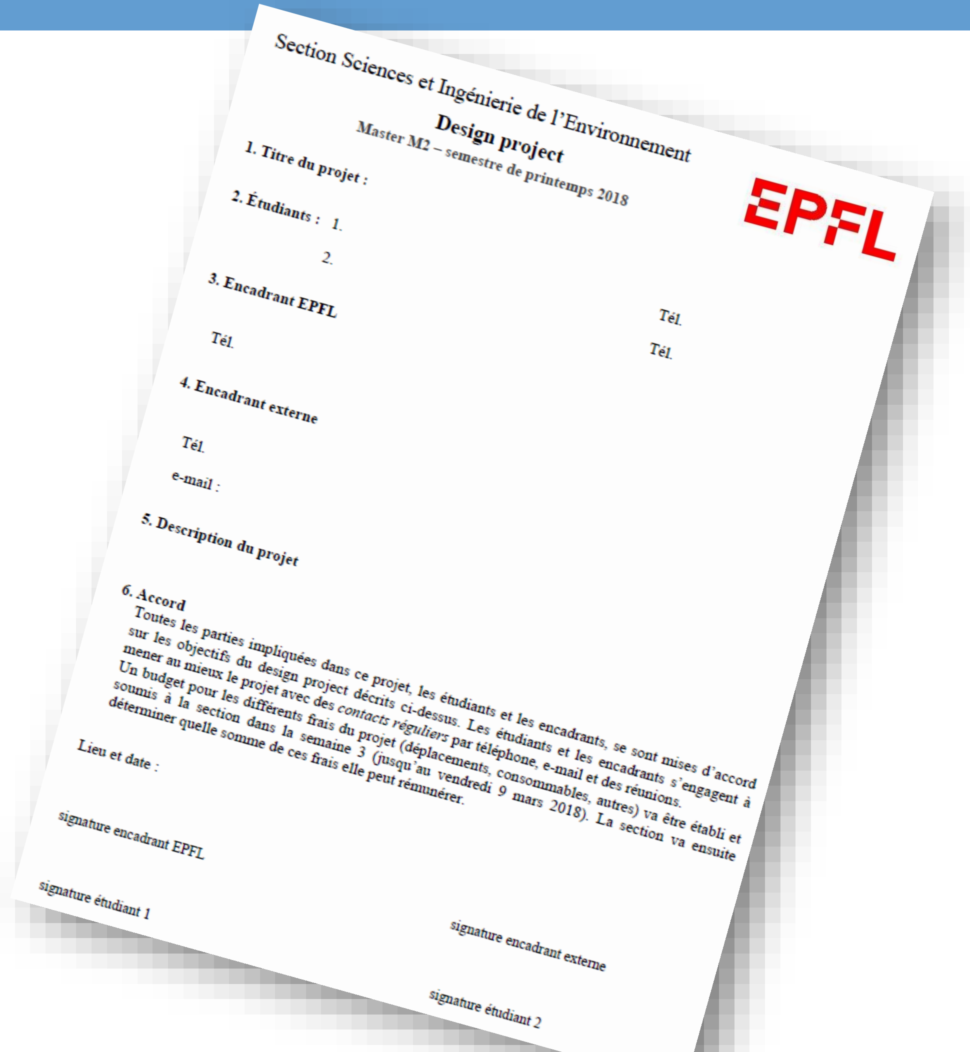
- DP: Master MA2; Bloc 1; 10 ECTS
- Work load ~ **2 days/week**
  - 10 ECTS = **250-300 hours x 2 students**
- Working in a team
  - Timeline, description of the tasks
  - Sharing the tasks
  - Distributing the work load during the semester
  - Realistic work flow

Week Organization (W#)

- W1: Kick-off meeting; Partner-Academic supervisor-You
- W2: Signature of the agreement and budget
- W3: Project proposal (3 pages, 10% of the grade)
- W9: Mid-term report, technical paper (4-6 pages, 15%)
- W13: Draft final report for review, setup of poster
- W14: Poster session & Final event
- W15: Final report (50%)
- Oral presentation (25%)

Agreement

- Elements of the agreement
  - Bilateral responsibilities
  - Topic
  - Names of parties
  - Signatures
    - Company representative
    - Academic supervisor
    - Students


Section Sciences et Ingénierie de l'Environnement

Design project

Master M2 – semestre de printemps 2018

1. Titre du projet :

2. Étudiants : 1.

2.

3. Encadrant EPFL

Tél.

Tél.

Tél.

4. Encadrant externe

Tél.

e-mail :

5. Description du projet

6. Accord

Toutes les parties impliquées dans ce projet, les étudiants et les encadrants, se sont mises d'accord sur les objectifs du design project décrits ci-dessus. Les étudiants et les encadrants s'engagent à mener au mieux le projet avec des *contacts réguliers* par téléphone, e-mail et des réunions. Un budget pour les différents frais du projet (déplacements, consommables, autres) va être établi et soumis à la section dans la semaine 3 (jusqu'au vendredi 9 mars 2018). La section va ensuite déterminer quelle somme de ces frais elle peut rémunérer.

Lieu et date :

signature encadrant EPFL

signature encadrant externe

signature étudiant 1

signature étudiant 2

Budget and Financial aspects

- Budget
  - Participation of the SIE Section to the costs
    - Travel
    - Some lab analysis
    - Various costs (small equipment)
  - Week 2: Submission of the Budget to the SIE Section (e-mail to christina.treier@epfl.ch)
- Reimbursement of expenses (at the end of the DP)
- Financial responsibility (one student/group)
  - Keeping accurate accounts
  - Record all the receipts, bills (original documents)
  - To inform the SIE Secretariat (Ch. Treier) in case of budget overrun

Travel

- **Use the public transportation:** keep your receipts/tickets for the reimbursement. No reimbursement for students who have a travel pass (ex. abonnement général)

- Possibility to book a car with Mobility car sharing
  - https://www.epfl.ch/campus/mobility/vehicles/mobility-carsharing/
  - Contact christina.treier@epfl.ch for booking

Varia

- Responsibility for equipment
  - In case of loss, theft and damage
  - Replacement is under the responsibility of the students
  - Use of your own insurance (theft, civil liability)
- Phone
  - No reimbursement of telecommunication expenses
    Use the softphone and/or videoconference applications
- Printing
  - Final report: 20.- /printed bound report; add in the budget
  - Number of copies to be defined with external partner
  - Poster: 10.-/A0 copy; use the ENAC printing service
    More information will follow in due time

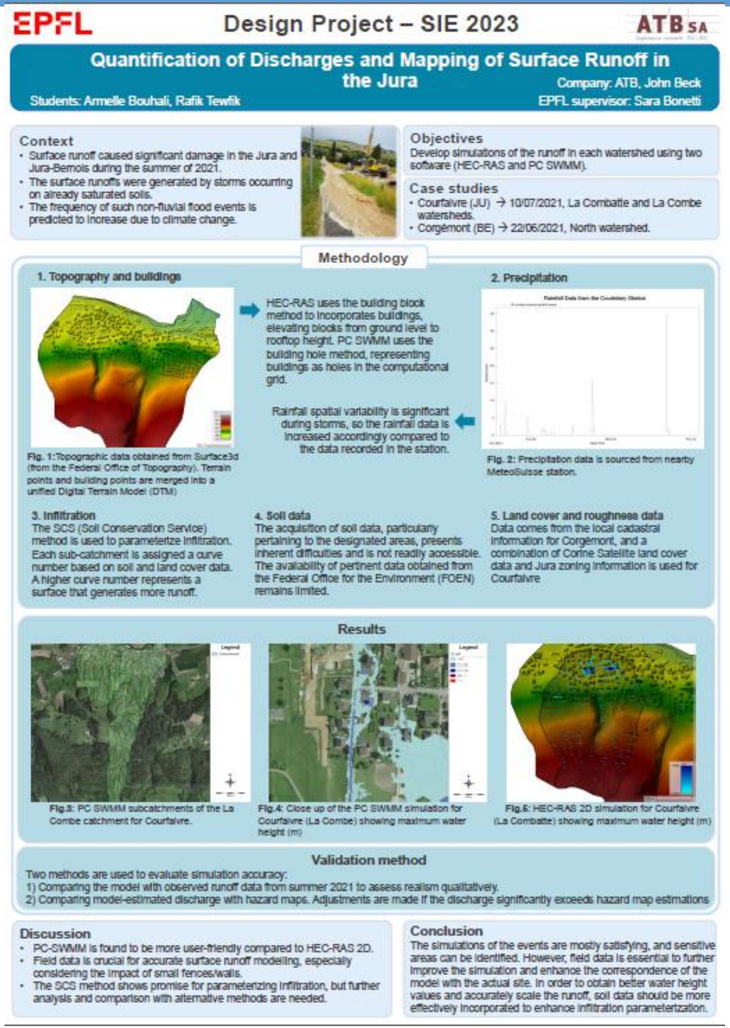
Starting the DP [SIE; students]

Collect of proposals and evaluation **List of topics on SIE web pages**	**~November 2025** **10th December 2025**
Building groups of 2 students **(preferably combine international with french speaking students)** **Choice and repartition of the topics**	**From 10th Dec. 25 until 9th January 2026** **Under the responsibility of students (one contact person for the Section)**
Final choice and communication to partners & professors	**Mid-January 2026**
Preliminary contacts with external partner and academic supervisor	**From January and before the beginning of the Spring semester**
Kick-off Meeting	**Friday 20th February 2026** (or another day during the week)

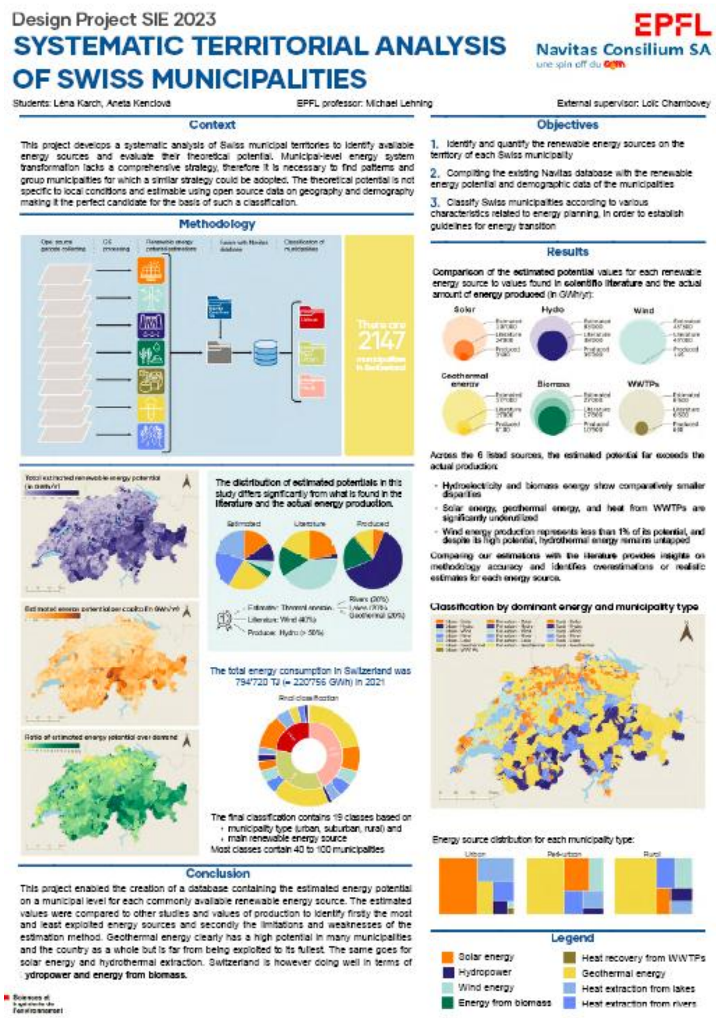
Report and Presentation

- Final Report
  - Draft version for a review by partner and academic supervisor
  - ~15 pages + annexes
  - Final version: to be submitted one week after the end of the semester
- Oral Presentation
  - 12-16 slides
  - Duration: 20 min (incl. discussion)
  - Scheduled by all parties; after the end of the semester
    - Individual organization by project
- Poster
  - Directives and templates provided by SIE Section
  - Public poster session: 29th May 2026, afternoon; incl. Apéro

Poster



Design Project – SIE 2023
Quantification of Discharges and Mapping of Surface Runoff in the Jura
Students: Armelle Bouhali, Rafik Tewfik
Company: ATB, John Beck
EPFL supervisor: Sara Bonetti
Context
Surface runoff caused significant damage in the Jura and Jura-Bernois during the summer of 2021.
The surface runoffs were generated by storms occurring on already saturated soils.
The frequency of such non-fluvial flood events is predicted to increase due to climate change.
Objectives
Develop simulations of the runoff in each watershed using two software (HEC-RAS and PC SWMM).
Case studies
Courfaivre (JU) → 10/07/2021, La Combatte and La Combe watersheds.
Corgémont (BE) → 22/06/2021, North watershed.
Methodology
1. Topography and buildings
HEC-RAS uses the building block method to incorporates buildings, elevating blocks from ground level to rooftop height. PC SWMM uses the building hole method, representing buildings as holes in the computational grid.
Fig. 1: Topographic data obtained from Surface3d (from the Federal Office of Topography). Terrain points and building points are merged into a unified Digital Terrain Model (DTM)
2. Precipitation
Rainfall spatial variability is significant during storms, so the rainfall data is increased accordingly compared to the data recorded in the station.
Fig. 2: Precipitation data is sourced from nearby MeteoSuisse station.
3. Infiltration
The SCS (Soil Conservation Service) method is used to parameterize infiltration. Each sub-catchment is assigned a curve number based on soil and land cover data. A higher curve number represents a surface that generates more runoff.
4. Soil data
The acquisition of soil data, particularly pertaining to the designated areas, presents inherent difficulties and is not readily accessible. The availability of pertinent data obtained from the Federal Office for the Environment (FOEN) remains limited.
5. Land cover and roughness data
Data comes from the local cadastral information for Corgémont, and a combination of Corine Satellite land cover data and Jura zoning information is used for Courfaivre
Results
Fig.3: PC SWMM subcatchments of the La Combe catchment for Courfaivre.
Fig.4: Close up of the PC SWMM simulation for Courfaivre (La Combe) showing maximum water height (m)
Fig.5: HEC-RAS 2D simulation for Courfaivre (La Combatte) showing maximum water height (m)
Validation method
Two methods are used to evaluate simulation accuracy:
1) Comparing the model with observed runoff data from summer 2021 to assess realism qualitatively.
2) Comparing model-estimated discharge with hazard maps. Adjustments are made if the discharge significantly exceeds hazard map estimations
Discussion
PC-SWMM is found to be more user-friendly compared to HEC-RAS 2D.
Field data is crucial for accurate surface runoff modelling, especially considering the impact of small fences/walls.
The SCS method shows promise for parameterizing infiltration, but further analysis and comparison with alternative methods are needed.
Conclusion
The simulations of the events are mostly satisfying, and sensitive areas can be identified. However, field data is essential to further improve the simulation and enhance the correspondence of the model with the actual site. In order to obtain better water height values and accurately scale the runoff, soil data should be more effectively incorporated to enhance infiltration parameterization.



Design Project SIE 2023
SYSTEMATIC TERRITORIAL ANALYSIS OF SWISS MUNICIPALITIES
Navitas Consilium SA
Students: Léna Karch, Aneta Kenclová
EPFL professor: Michael Lehning
External supervisor: Loïc Chambovey
Context
This project develops a systematic analysis of Swiss municipal territories to identify available energy sources and evaluate their theoretical potential. Municipal-level energy system transformation lacks a comprehensive strategy, therefore it is necessary to find patterns and group municipalities for which a similar strategy could be adopted. The theoretical potential is not specific to local conditions and estimable using open source data on geography and demography making it the perfect candidate for the basis of such a classification.
Objectives
1. Identify and quantify the renewable energy sources on the territory of each Swiss municipality
2. Completing the existing Navitas database with the renewable energy potential and demographic data of the municipalities
3. Classify Swiss municipalities according to various characteristics related to energy planning, in order to establish guidelines for energy transition
Methodology
There are 2147 municipalities in Switzerland
Results
Comparison of the estimated potential values for each renewable energy source to values found in scientific literature and the actual amount of energy produced (in GWh/yr):
Solar
Hydro
Wind
Geothermal energy
Biomass
WWTPs
Across the 6 listed sources, the estimated potential far exceeds the actual production:
Hydroelectricity and biomass energy show comparatively smaller disparities
Solar energy, geothermal energy, and heat from WWTPs are significantly underutilized
Wind energy production represents less than 1% of its potential, and despite its high potential, hydrothermal energy remains untapped
Comparing our estimations with the literature provides insights on methodology accuracy and identifies overestimations or realistic estimates for each energy source.
The distribution of estimated potentials in this study differs significantly from what is found in the literature and the actual energy production.
Estimated
Literature
Produced
The total energy consumption in Switzerland was 794'720 TJ (= 220'756 GWh) in 2021
Final classification
The final classification contains 19 classes based on
municipality type (urban, suburban, rural) and
main renewable energy source
Most classes contain 40 to 100 municipalities
Classification by dominant energy and municipality type
Energy source distribution for each municipality type:
Urban
Peri-urban
Rural
Conclusion
This project enabled the creation of a database containing the estimated energy potential on a municipal level for each commonly available renewable energy source. The estimated values were compared to other studies and values of production to identify firstly the most and least exploited energy sources and secondly the limitations and weaknesses of the estimation method. Geothermal energy clearly has a high potential in many municipalities and the country as a whole but is far from being exploited to its fullest. The same goes for solar energy and hydrothermal extraction. Switzerland is however doing well in terms of hydropower and energy from biomass.
Legend
Solar energy
Hydropower
Wind energy
Energy from biomass
Heat recovery from WWTPs
Geothermal energy
Heat extraction from lakes
Heat extraction from rivers

DP - Important Dates - 2026

- **Friday 20th February** : 1st meeting between the 3 parties (students, partner and SIE Professor)
- **To be defined** (12h-13h – room TBD): permanence office hour on the information sources, and literature search, by Myriam Petrilli, Teaching Librarian
- **Friday 27th February** : submission of the signed contract and budget estimation to the Section
- **Friday 6th March** : submission of the goals, expectations and calendar to the SIE Professor and external partner
- **Friday 17th April** : submission of intermediate report to the SIE Professor and external partner
- **Wednesday 20th May** : deadline for sending the PDF version of report to the SIE Professor and external partner for comments before finalization
- **Monday 28th May:** between 13h00 and 17h00 : printing of A0 poster at SG 0215 office (ENAC-IT)
- **Friday 29th May**: **poster session of the Design Projects, from 14h to 17h, GR 3rd floor**
- **Friday 5th June** : submission of the final report version (PDF) to the SIE Professor and partner
- **Between 1st and 12th June** : oral presentation of the Design Projects
- **Monday 13th July** : submission of the grades to the SAC (by SIE Professors)

QUESTIONS

Web Page: [Design Project]

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