

# Modeling the Realistically Sustainable Potential of Forest Wood Supplies for Energetic Use

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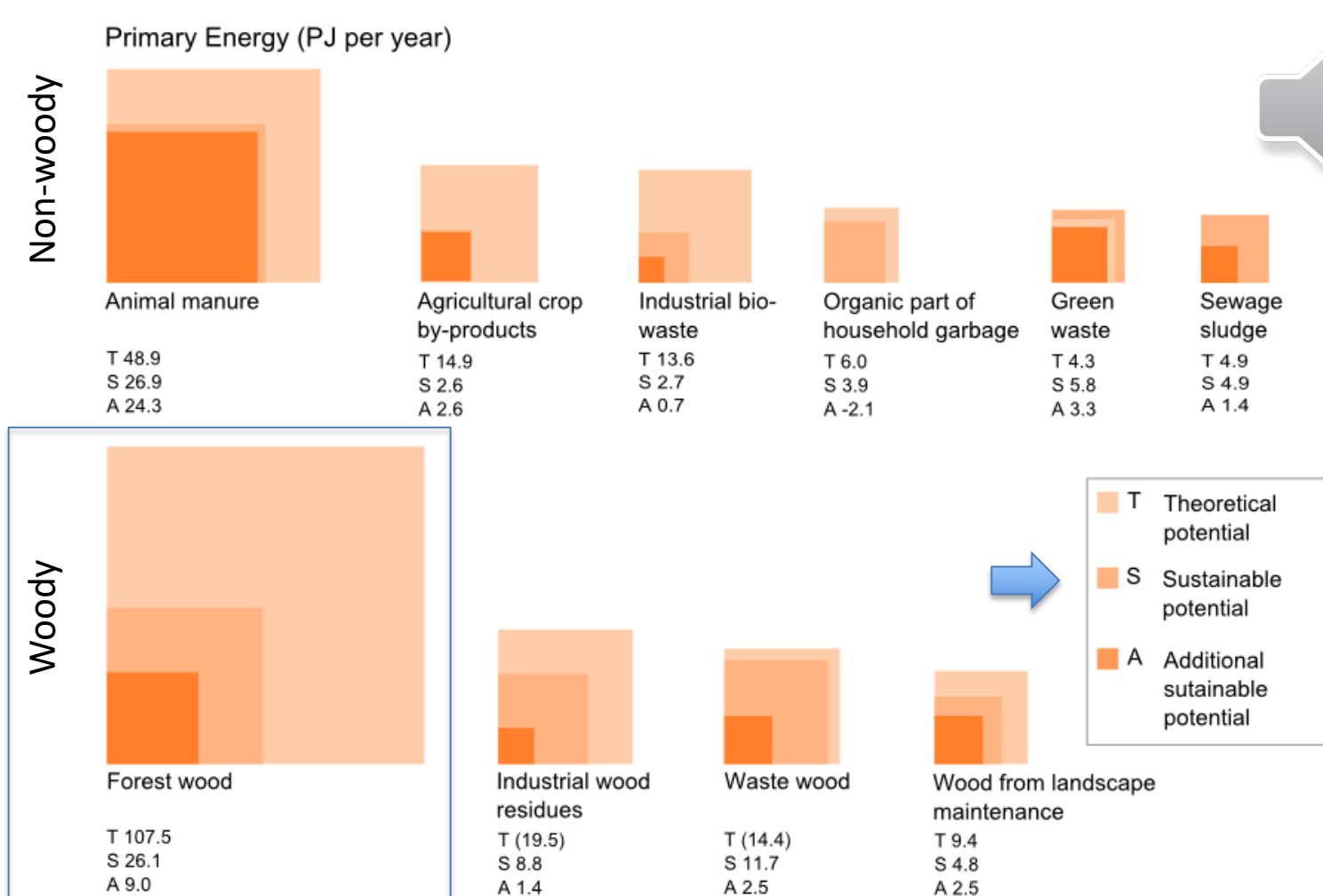
<sup>\*2</sup> PennState University (psu)



Doctoral school, EPFL, 9.11.2020

# Background:

## Assessment of the domestic biomass potential for energy in CH

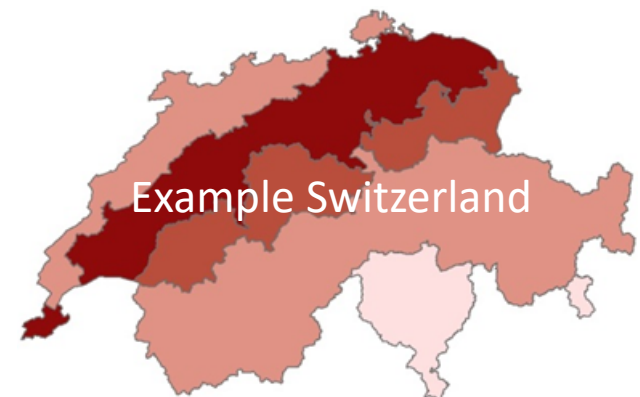




# Research tasks

## Quantifying the available **forest energy wood potential**

- Analysing **management scenarios** under **realistic** ecological and economical **constraints**
- Investigating the **regional distribution**
- Quantifying **supply costs** and evaluate the impact of **subsidies**

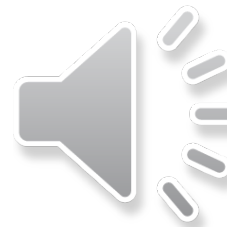




# Management scenarios

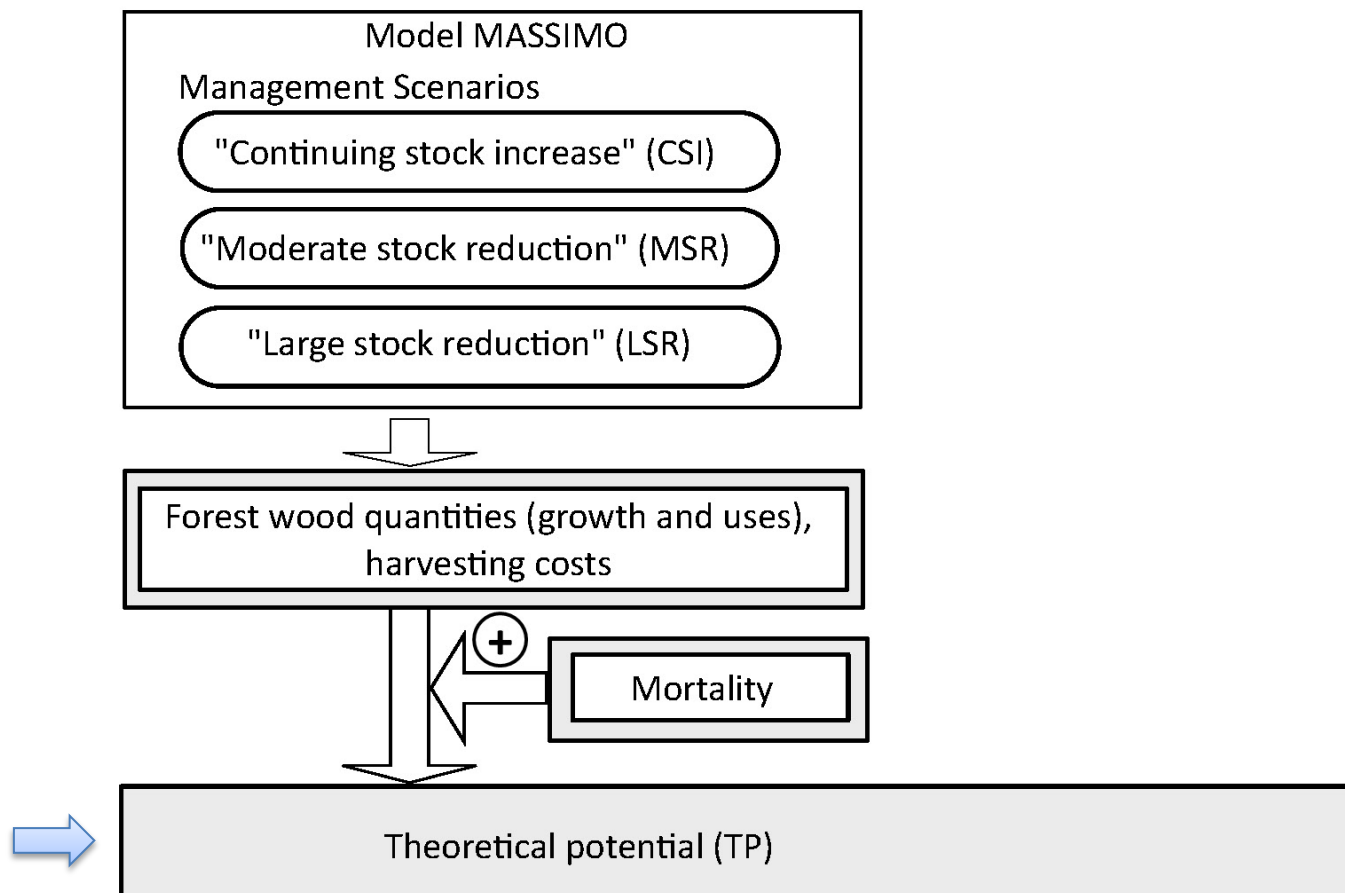
| Forest management scenario                                                                                | Stock and utilisation targets                                                                            |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| <p>Continuing <b>stock increase</b> (CSI)</p> <p>-&gt; Business as usual</p> <p>-&gt; Use &lt; growth</p> | <p><b>Constant</b> use between NFI 3 (2004/2006) and NFI 4b (2009/2013)</p>                              |
| <p>Moderate <b>stock reduction</b> (MSR)</p>                                                              | <p>Stock reduction to <b>300m<sup>3</sup>/ha</b> till 2046, after constant</p>                           |
| <p>Large <b>stock reduction</b> (LSR)</p>                                                                 | <p>Stock reduction till 2046 with regional different stock targets (<b>200/300 m<sup>3</sup>/ha</b>)</p> |





# Conceptual model

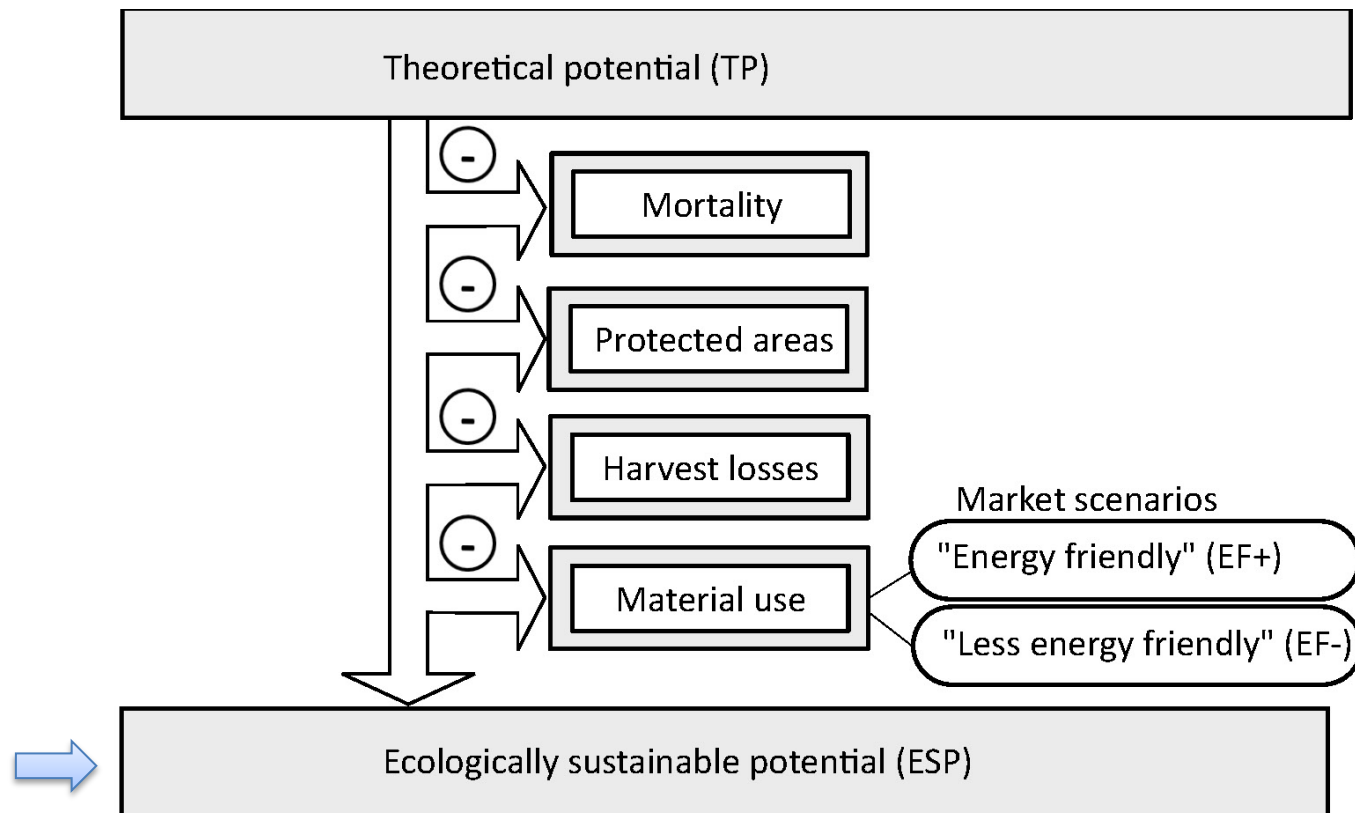
## Determination of theoretical potential





# Conceptual model

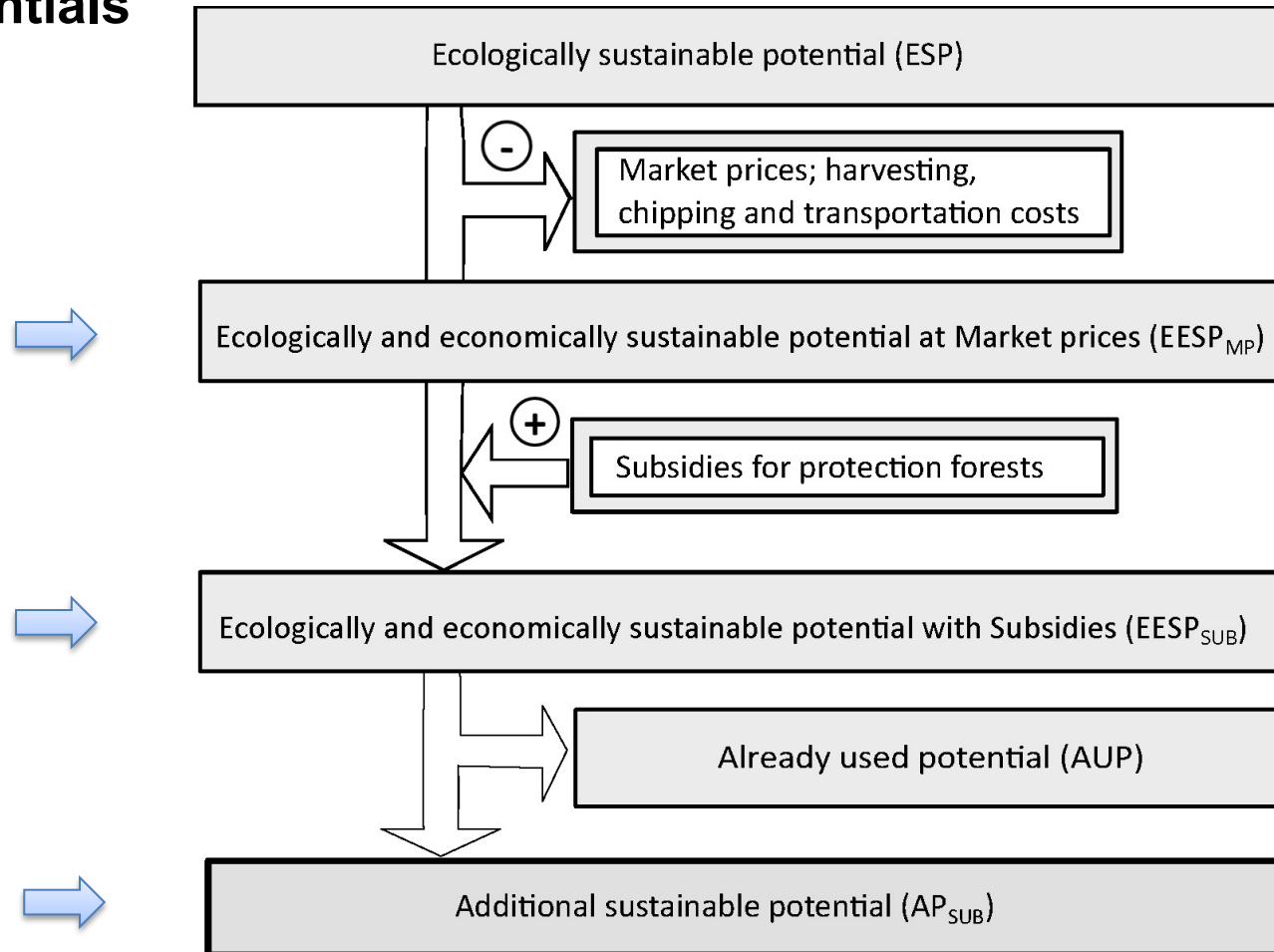
## Determination of the ecologically sustainable potential





# Conceptual model

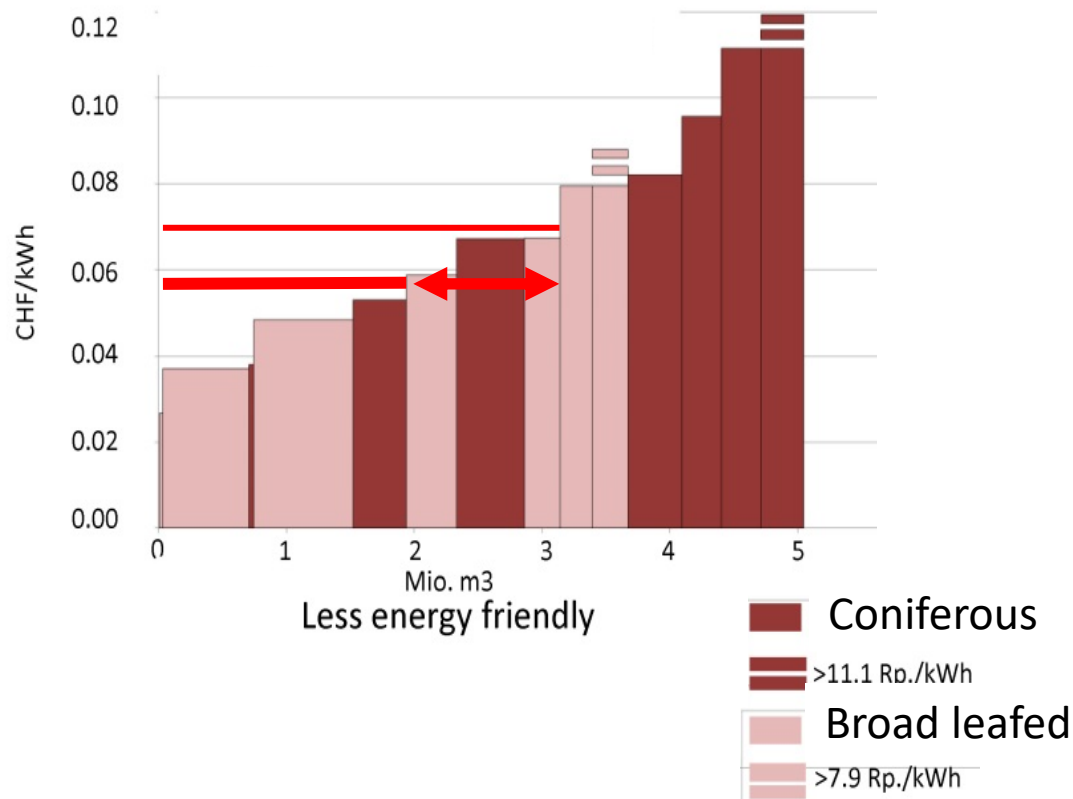
## Determination of the ecologically and economically sustainable potentials





# Ecological potentials by supply costs

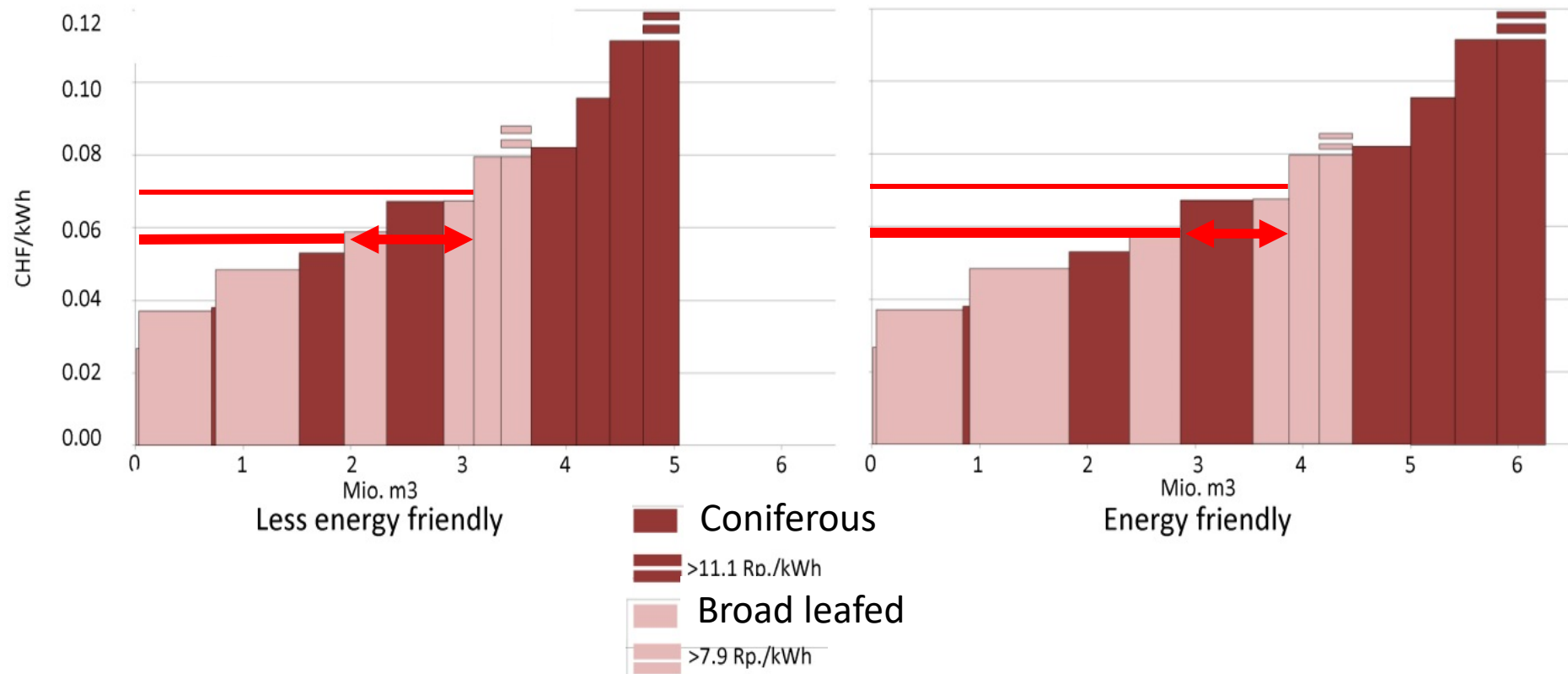
scenario moderate stock reduction, 2017-2026





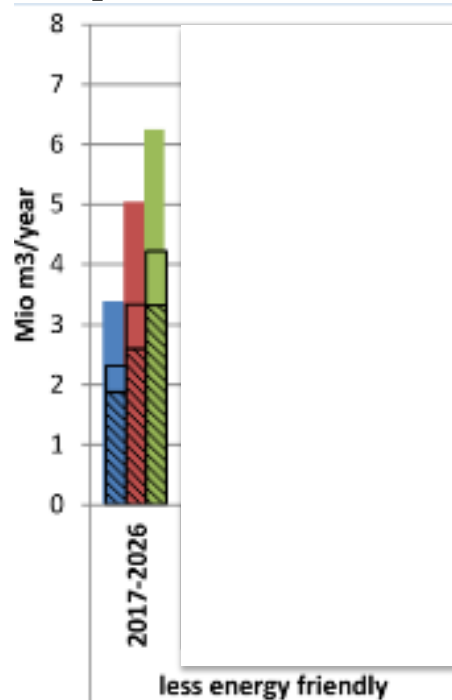
# Ecological potentials by supply costs

scenario moderate stock reduction, 2017-2026





# Sustainable potentials by management scenarios

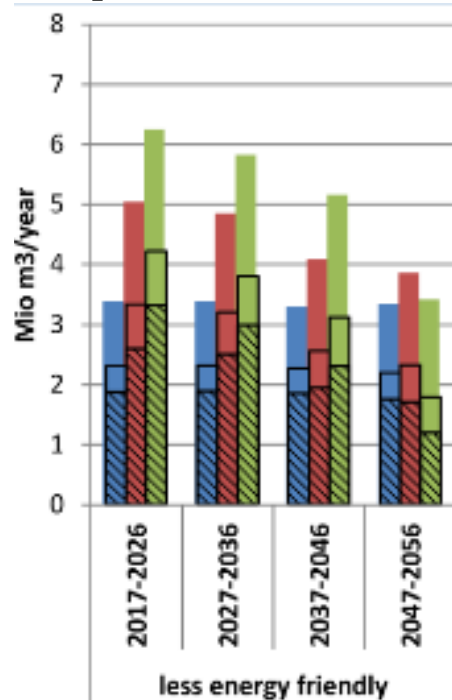


- Continuous stock increase (CSI) ■ Moderate stock reduction (MSR) ■ Large stock reduction (LSR)
- Colored bars: Ecologically sustainable potential (ESP)
- Ecologically Economically Sustainable Potential with Subsidies in Protection Forests (EESPSUB)
- ▨ Ecologically Economically Sustainable Potential at Market Price 5.9 Rp./kWh (EESP)





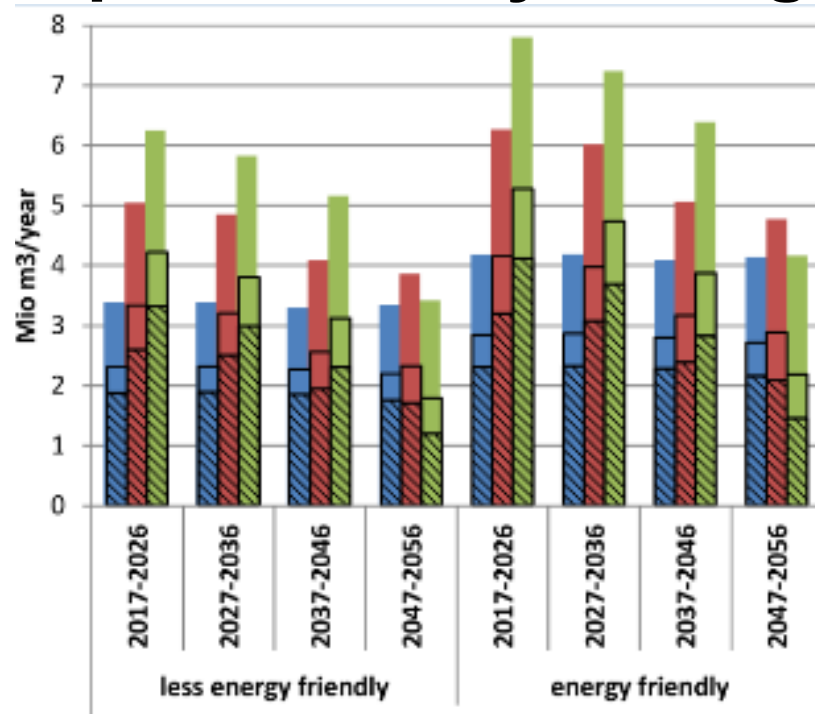
# Sustainable potentials by management scenarios



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# Sustainable potentials by management scenarios



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## Subsidy effect



Without subsidies  
for protection forests  
(according to market prices):  
20.8 PJ/year

With subsidies  
for protection forests:  
25.9 PJ/year

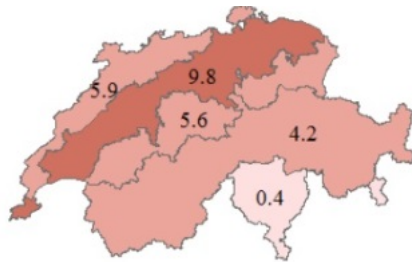
-> + 25%

(Scenario «moderate stock reduction»  
and Wood market «less energy wood  
friendly, 2017 -2026)



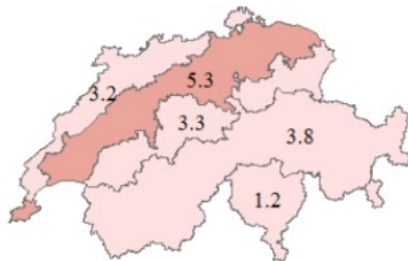
# Sustainable potentials by regions

Moderate stock reduction, 2017-26



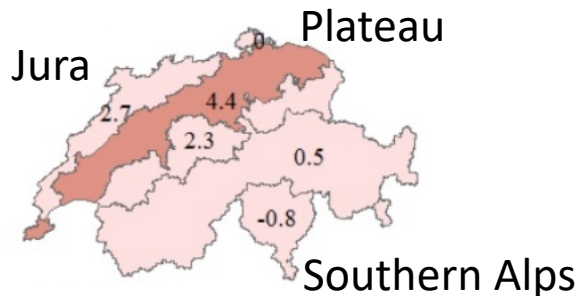
**Ecologically-Economically Sustainable Potential with Subsidies,**

Less energy wood friendly wood market situation



**Already-Used Potential,**

Current situation



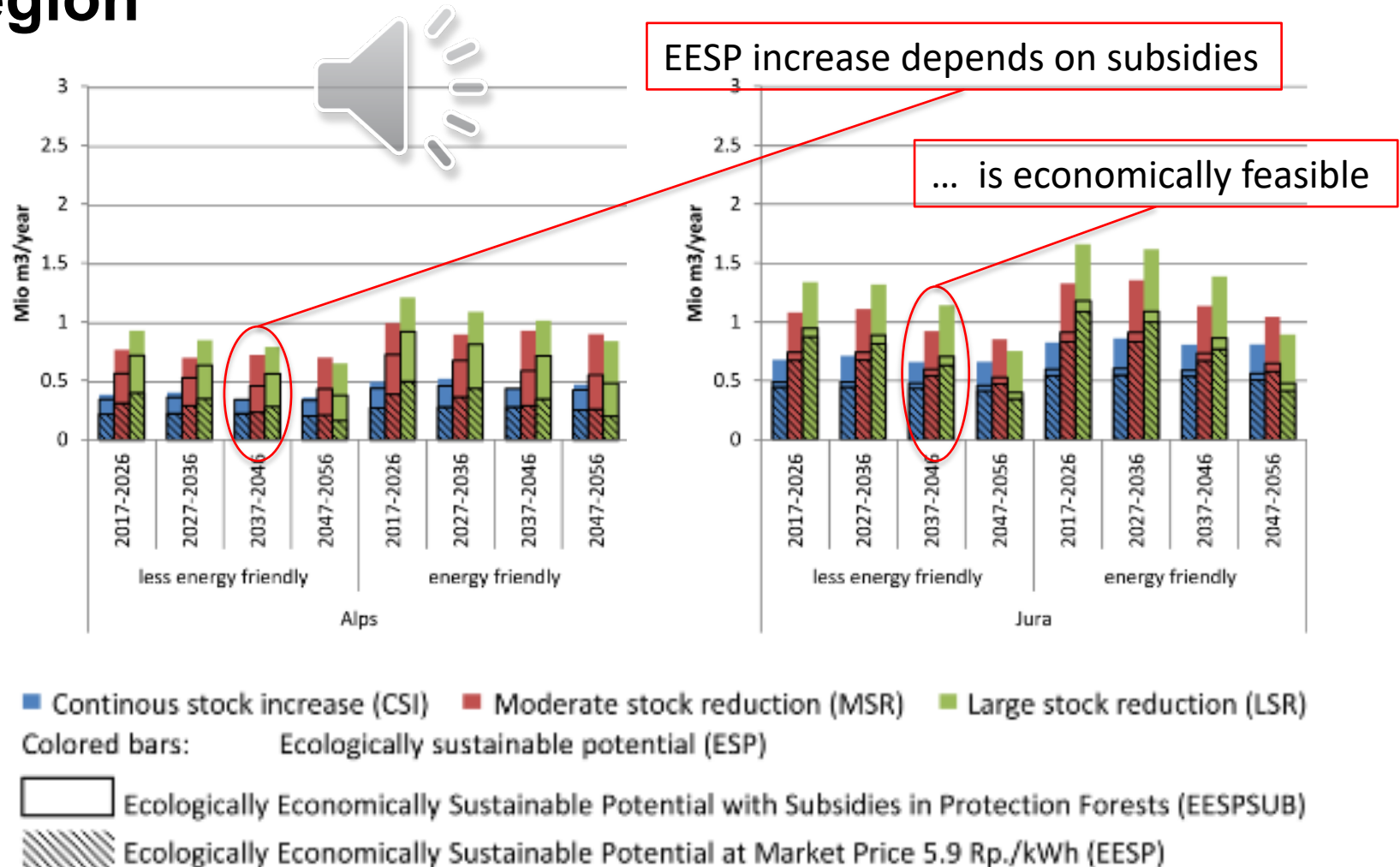
**Additional Potential with Subsidies,**

Less energy wood friendly market situation

PJ (Primary energy)



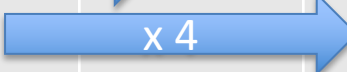
# Sustainable potentials in the Alps and the Jura region



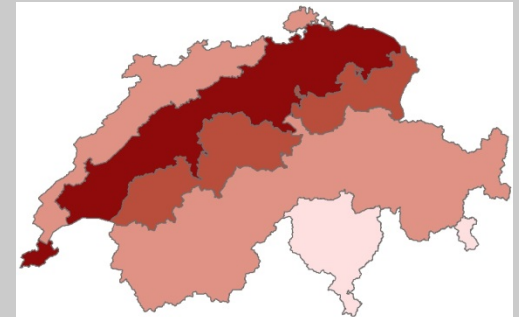


# Summary

## Potentials of Forest Energy Wood in Switzerland (2017-2056)

| Forest management scenarios                                     | Continuous stock increase                                                                                                                                                         | Moderate stock reduction | Large stock reduction |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------|
| Theoretical potential                                           | 88.1 PJ<br>100%* <sup>1</sup>                                                                                                                                                     | 90.6 PJ<br>103%          | 97.1 PJ<br>110%       |
| Ecologically sustainable potential                              | 32%                                                                                                                                                                               | 42%                      | 49%                   |
| Ecologically-economically sustainable potential with subsidies  | 22%                                                                                                                                                                               | 28%                      | 32%                   |
| Ecologically-economically sustainable potential at market price | 19%                                                                                                                                                                               | 24%                      | 25%                   |
| Additional potential with subsidies                             | 3%  9%<br> | 13%                      |                       |

... and their spatial distribution



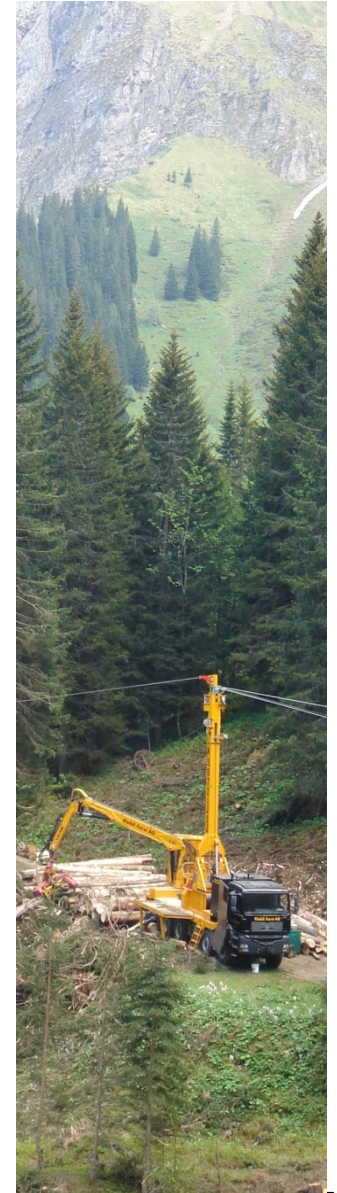
\*<sup>1</sup> reference value





## Conclusions

- **Potentials not stable:** depending on forest management and wood market situation
- **Potentials sensitive** on wood- and energy prices
- **Moderate stock reduction promising** if feasible
- **Short term advantage** of the intensive strategies
- **Regional investments promising** in Plateau and Jura
- **Realistic potentials of energy wood supplies need**
  - detailed analysis of restrictions and spatial distribution
  - dynamic simulations and comprehensible methods







**biosweet**

Biomass for Swiss Energy Future  
Swiss Competence Center for Energy Research

# Thank you for your interest!



More Information:

- Thees, O.; Erni, M.; Lemm, R.; Stadelmann, G.; Zenner, E.K. (2020), Future potentials of sustainable wood fuel from forests in Switzerland. *Biomass and Bioenergy*
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