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Stimulating fuelwood consumption through public policies: An assessment of economic and resource impacts based on the French Forest Sector Model

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HIGHLIGHTS

- We compare the bio-economic impacts of policies to boost fuelwood consumption in France.
- We simulate a producer subsidy, a consumer subsidy and fixed public demand contracts.
- We explore their impacts until 2020 with a dynamic model of the forest sector.
- Producer subsidy reduces the trade balance deficit and decreases forest stock.
- Consumer subsidy increases consumer welfare and public contracts reduce budgetary costs.

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ABSTRACT

Stimulating renewable energy is a crucial objective in view of tackling climate change and coping with future fossil fuel scarcity. In France, fuelwood appears to be an important source for the renewable energy mix. Using the French Forest Sector Model, our paper aims to assess the impacts of three policy options to stimulate fuelwood consumption: a consumer subsidy, a producer subsidy and a fixed-demand contract policy. We explored their impacts in terms of five groups of criteria: (1) forest resource dynamics; (2) variations in wood products prices and quantities consumed and produced; (3) trade balance; (4) budgetary costs; and (5) variations in agent surpluses. We show that no policy option is more desirable than another on the basis of all of these criteria and that trade-offs will determine which is the best policy option to be implemented.

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1. Introduction

In 2011, renewable energy represented about 15.3% of the total production of French primary energy, i.e. about 21.2 Mtoe. The European directive 2009/28/EC has set the objective of increasing the share of renewable energy in French energy mix to 23% by 2020. In France, where forest resources are abundant—France has the fourth largest forest cover among of the 25EU countries—biomass energy is expected to play a major role in achieving this objective. As shown in Fig. 1, using wood for heat production emits far less CO_2 than other energy sources for the same energy service[1]. This is mainly because carbon emissions during fuelwood combustion are compensated for by storage during forest regrowth, provided that fuelwood originates from sustainably managed forests (a condition that is met in France).

Within this context, several programs to stimulate the fuelwood sector have recently been implemented. These programs aim at (1) structuring the French fuelwood sector through economic incentives, (2) changing domestic heating systems, for example, through the

[1] This figure is based on data from Petersen (2006) for fuelwood products in Norway and data from Traisnel et al. (2010) for fossil fuels in France. Petersen (2006) accounts for all emissions from harvest, transport and the production of GHG emission other than CO_2 from the burning of wood. Even if Traisnel et al. (2010) only account for "direct emissions", i.e., those from fossil fuel combustion, we can see that emissions from fossil fuels largely exceed those of fuelwood products.

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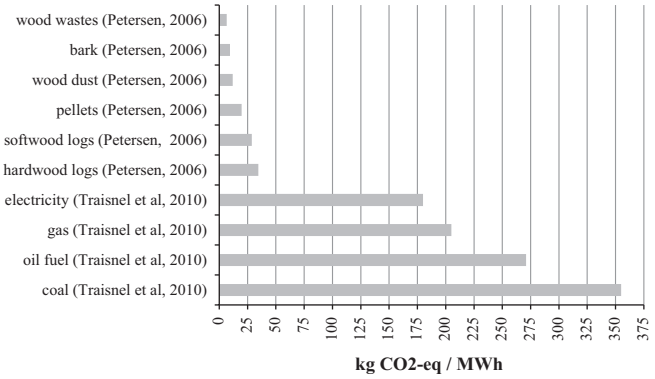

Fig. 1. Comparison of CO_2 emissions from different fuel sources for heat production.

development of collective boilers, and (3) encouraging the development of medium- to large-scale biomass energy plants. These programs encompass (i) the "Plans bois-énergie" programs of the ADEME (The French Agency for the Environment and Energy) which consist in subsidizing the implementation of local collective boilers, (ii) CRE (Energy Regulation Commission) projects that consist in the implementation of biomass power plants, (iii) the program called "1000 chaufferies pour le milieu rural", which makes possible for rural communities to implement collective boilers and (iv) the "renewable heat funds" that allow manufacturers to invest in collective heating system projects.

The overall objective of these programs is to increase fuelwood consumption by 6 Mm^3/yr by 2020, which represent 1.38 Mtoe/yr. In 2012, France was already consuming more than 10 Mtoe/yr (40 Mm^3/yr) of fuelwood, almost exclusively for domestic heat production, of which more than 80% was exchanged through informal channels (Montagné and Niedzwiedz, 2009). The recent programs to stimulate fuelwood sector aim at increasing fuelwood consumption by about 15%, of which 66% will be used for electricity production in cogeneration plants, 28% for heat production in collective and industrial boilers and 6% for heat production in domestic boilers.

However, the impacts of these programs on the economy of the forest sector remain unclear. First, by competing for the same raw products, these projects could strengthen the competition with the pulp, panel and paper sectors and could, therefore, increase the price of these products for consumers. Second, the costs of these programs and the distribution of these costs among consumers (both fuelwood consumers and other wood products consumers), producers and the French Government are unknown. Third, while the forest sector represents the second trade balance deficit pole in France after energy, impacts of these programs on the trade balance are uncertain.

In addition, even if an additional 12 Mm^3/yr harvest seems to be physically and economically possible (Colin et al., 2009; Ginisty et al., 2009), uncertainty remains regarding forest-owners' responses to economic incentives. Indeed, in France, 70% of forests owners have a forest less than 1 ha, and forests smaller than 4 ha represent almost 70% of the whole forest area. Since small forest owners might not react to economic incentives, there is important uncertainty as to how much wood would be available for harvest in forests. In this context of uncertainty about available resources, the sustainability of the programs to stimulate fuelwood consumption must be questioned.

The aim of this paper is to clarify these debates by assessing the impacts of potential public policies designed to stimulate fuelwood consumption on (1) the economy of the sector and on (2) the forest resources. To do this, we translate the official objectives of additional fuelwood consumption into three policies to be simulated within the French Forest Sector Model (FFSM), a bio-economic model of the French forest sector (Caurla et al., 2010; Caurla, 2012b).

First, we model an exogenous increase in demand, which mimics the current policy of encouraging the development of medium- to large-scale biomass energy plants. In this case, the Government guarantees a given amount of public purchase on the market (*fixed-demand contracts*). We also consider two alternative policies to reach the same total increase in fuelwood demand: a *consumer* and a *producer subsidy*. These two subsidies represent economic incentives to change collective and domestic boilers.

We then compare these three policies by assessing their impacts on both the economy of the forest sector and the dynamics of the forest resource. On the one hand, we would expect a fuelwood policy to be sustainable, meaning that it should not lead to depletion of the forest stock. To question the sustainability of the three policies tested, we focus on the impacts of these policies on forest stock dynamics. On the other hand, we would expect a fuelwood policy to reduce the French trade balance at minimal cost and without increasing competition with other forest industries. To test this, we explore trade implications and compute the total cost of policies, differentiating between the cost for the French Government (budgetary cost) and the variations in consumer and producer surpluses. We analyze the implications of these policies over the 2012–2020 period which is short in relation to forest dynamics, but very relevant in terms of policy making. To make the comparison meaningful, the three policies were calibrated to reach the same additional $+6$ Mm^3/yr fuelwood consumption by 2020.

The paper is organized as follows: Section 2 presents a short literature review on the issue of forest biomass, public policies and energy. Section 3 briefly presents FFSM. Section 4 focuses on the policies to be implemented. Section 5 presents the impacts of policies on the resource, while Section 6 describes their economic impacts. Section 7 provides a discussion of our results and a conclusion to our paper.

2. Forest biomass, public policies and energy: a short literature review

The impacts of fuelwood policies over the forest sector have been studied both from environmental and economic points of view.

From economic aspects, Delacote and Lecocq (2011) points out that several studies show critical interrelations between fuelwood production and other wood products such as timber and pulpwood. Using a spatial partial equilibrium model for Finland, Kallio et al. (2011) show that renewable energy targets are not realistic without considering policies that increase timber production. Using the U.S. Forest Products Module (USFPM) of the Global Forest Products Model (GFPM), Ince et al. (2011) also show that fuelwood development highly depends on the driving effects of the construction sector.

In addition, some studies insist on the potential contradictions of fuelwood policies and possibly non-targeted incentives for carbon sequestration in forest. Lecocq et al. (2011) show that combining a sequestration policy with a fuelwood policy would lead to conflicting incentives to wood suppliers. Lecocq et al. (2011) for France and Kallio et al. (in press) for Finland both show that, in the short run (2020–2035), sequestration incentives may perform better from an emissions reduction point of view than policies to boost fuelwood consumption. Eventually, at the global level and using GFPM, Buongiorno et al. (2011) show that reaching the level of bio-energy uses suggested by the Intergovernmental Panel for Climate Change would increase world forests depletion.

However, the question of the choice of the economic instrument to reach fuelwood consumption target in European countries has been barely studied. One exception for Norway is Sjølie et al. (2010) who compare a tax on fossil fuels with investment grants to district heating installation. They find that a tax of 60€/CO_2eq on fossil fuels

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