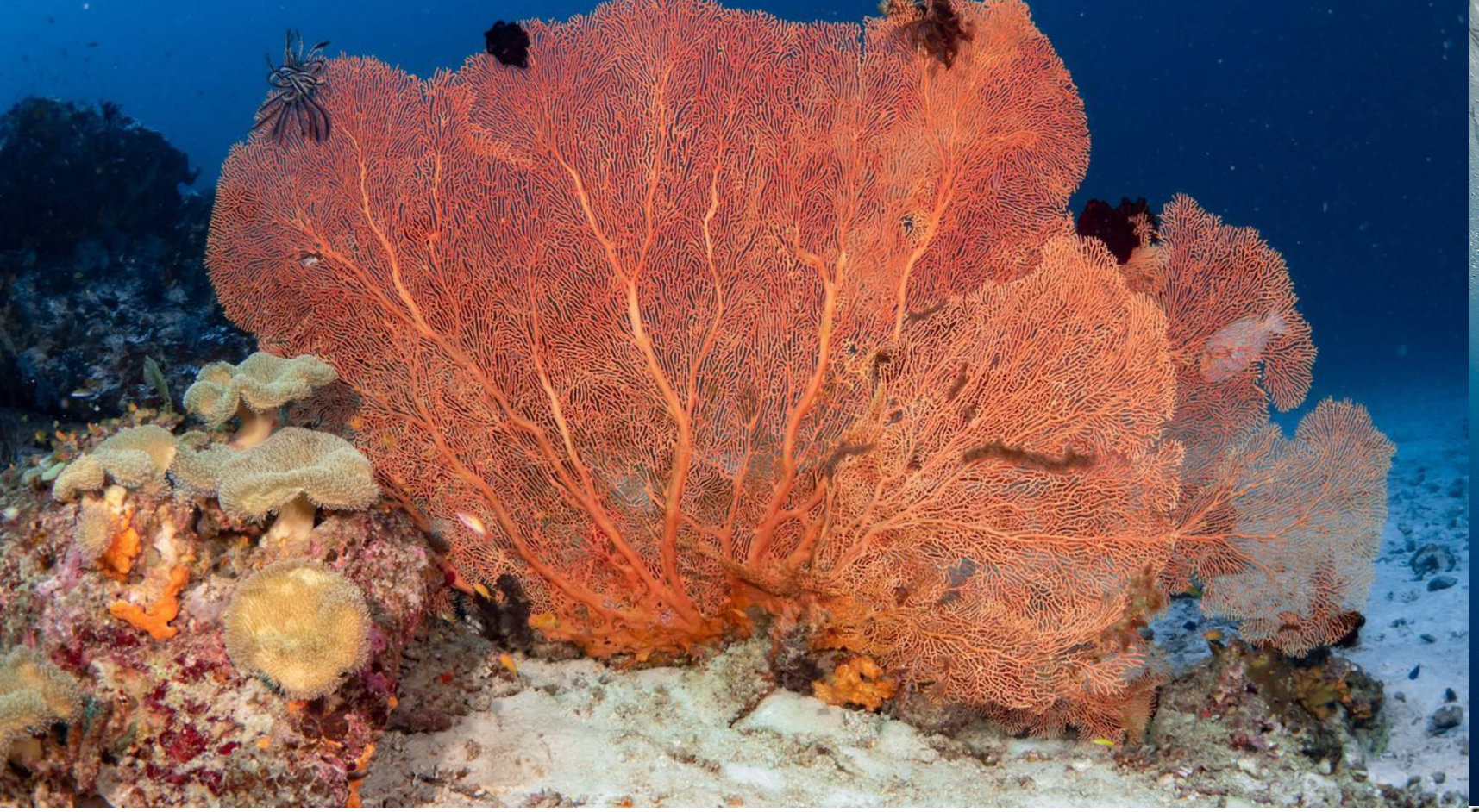
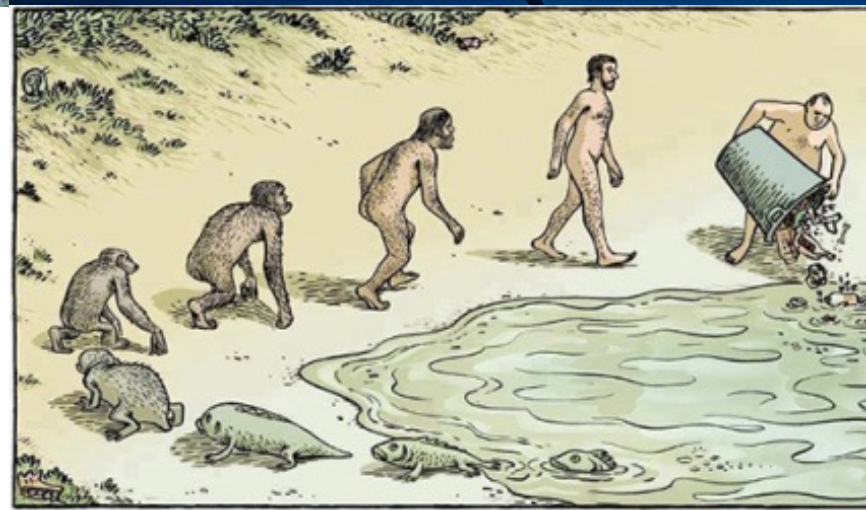


EE476
Environmental Economics

Lecture 4

2022



THE THEORY OF EXTERNALITIES

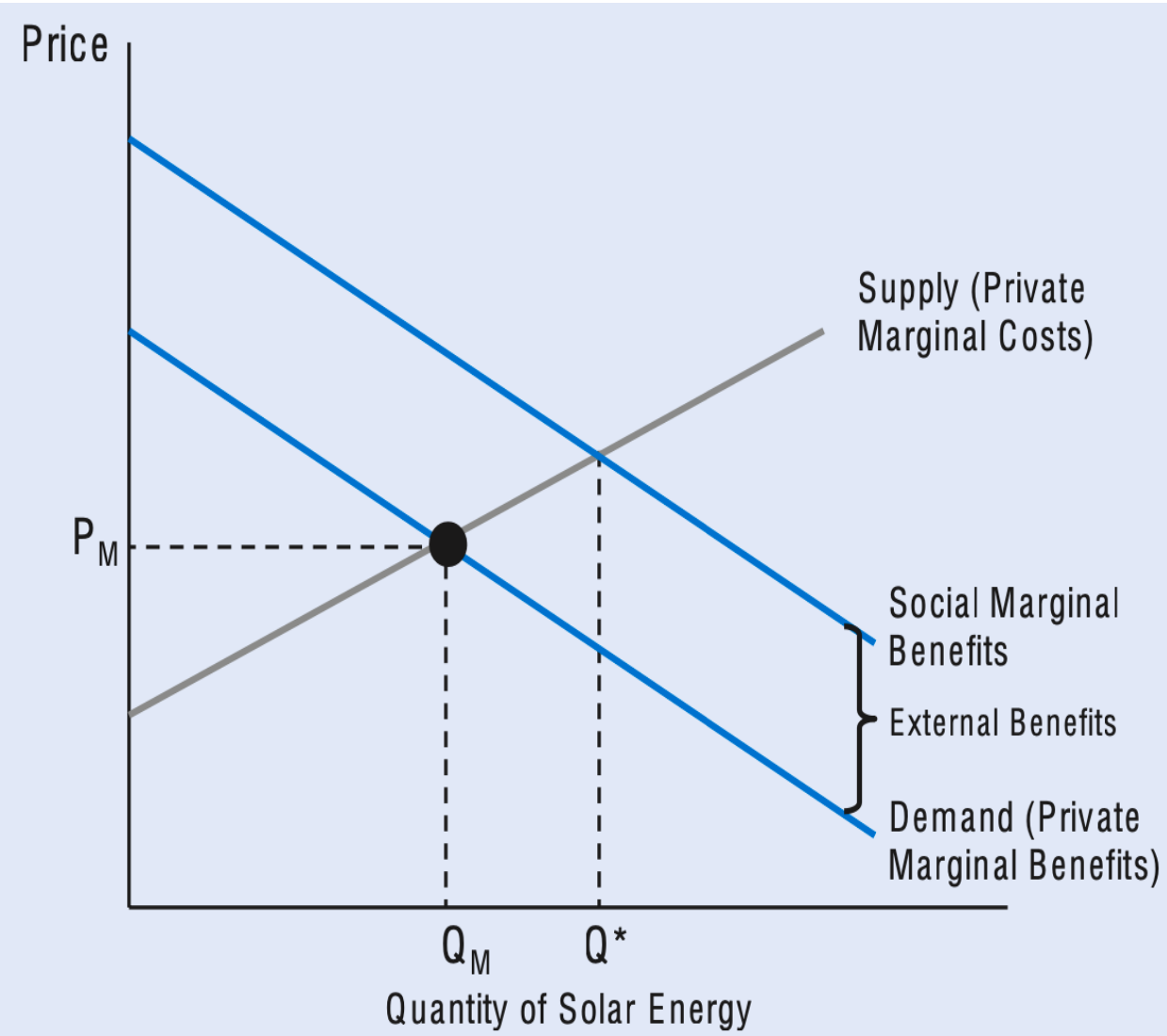
- Externalities is arising when the actions of some individuals have direct effects on the welfare or utility of other individuals, none of whom have direct control over that activity.

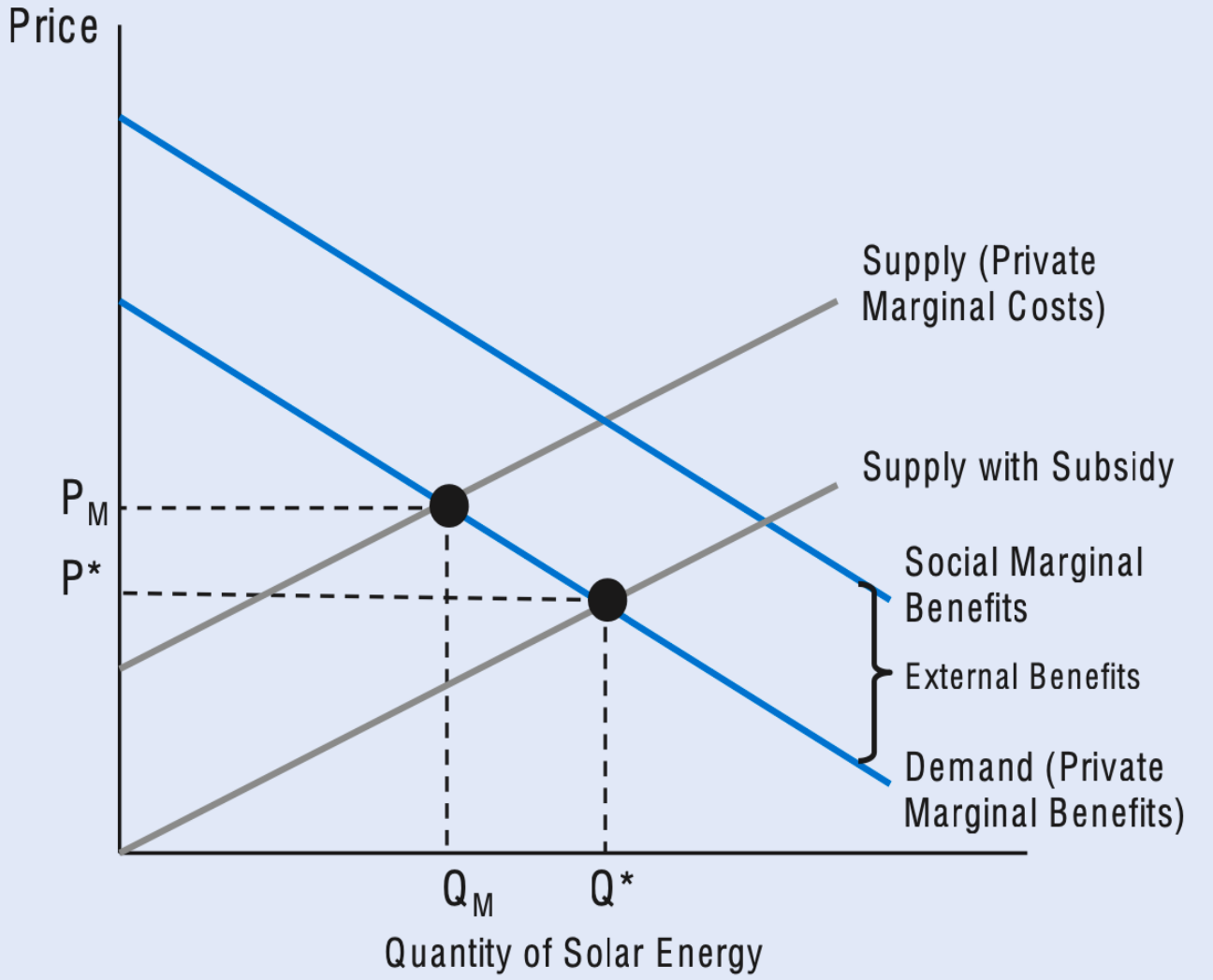
- Externalities can be either positive or negative.

- In a situation where a *positive externality* is present

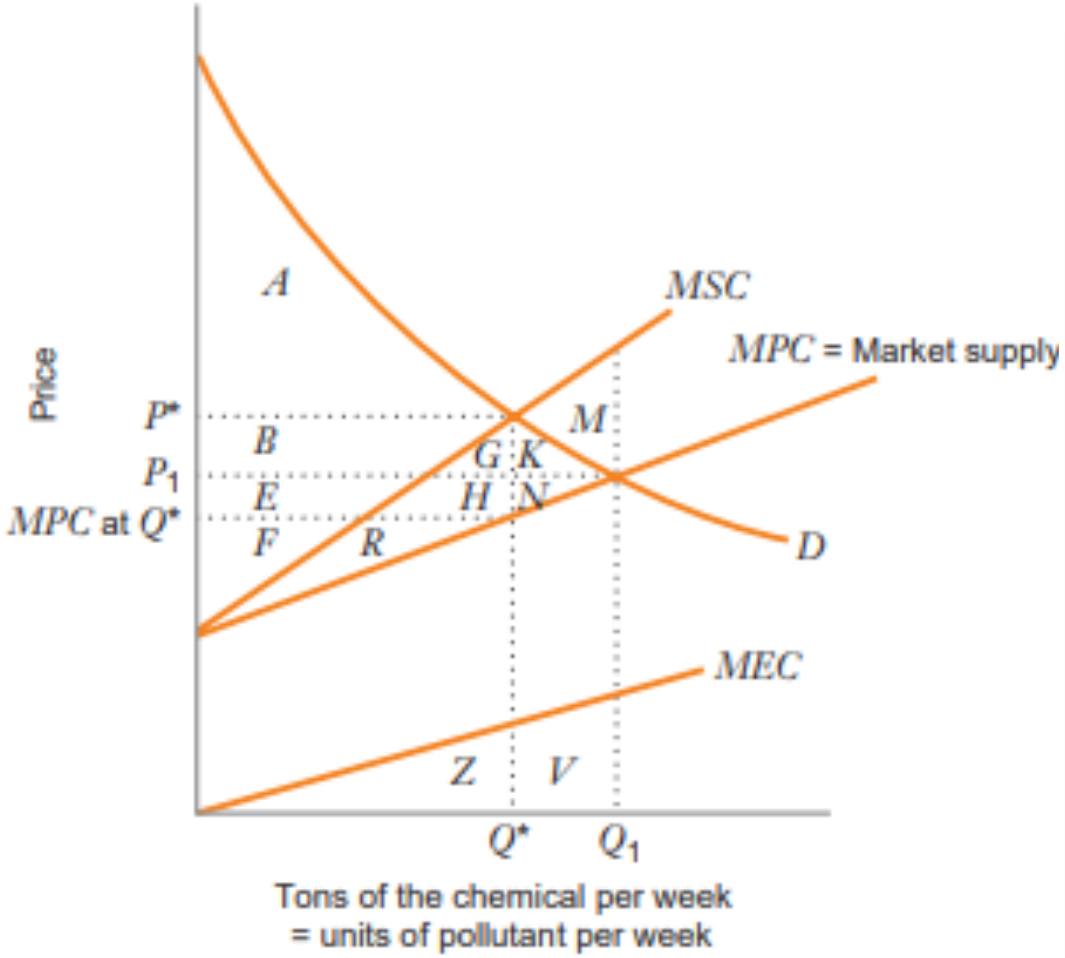
  Social benefits = Private benefits + External benefits

Optimal level of production with positive externalities



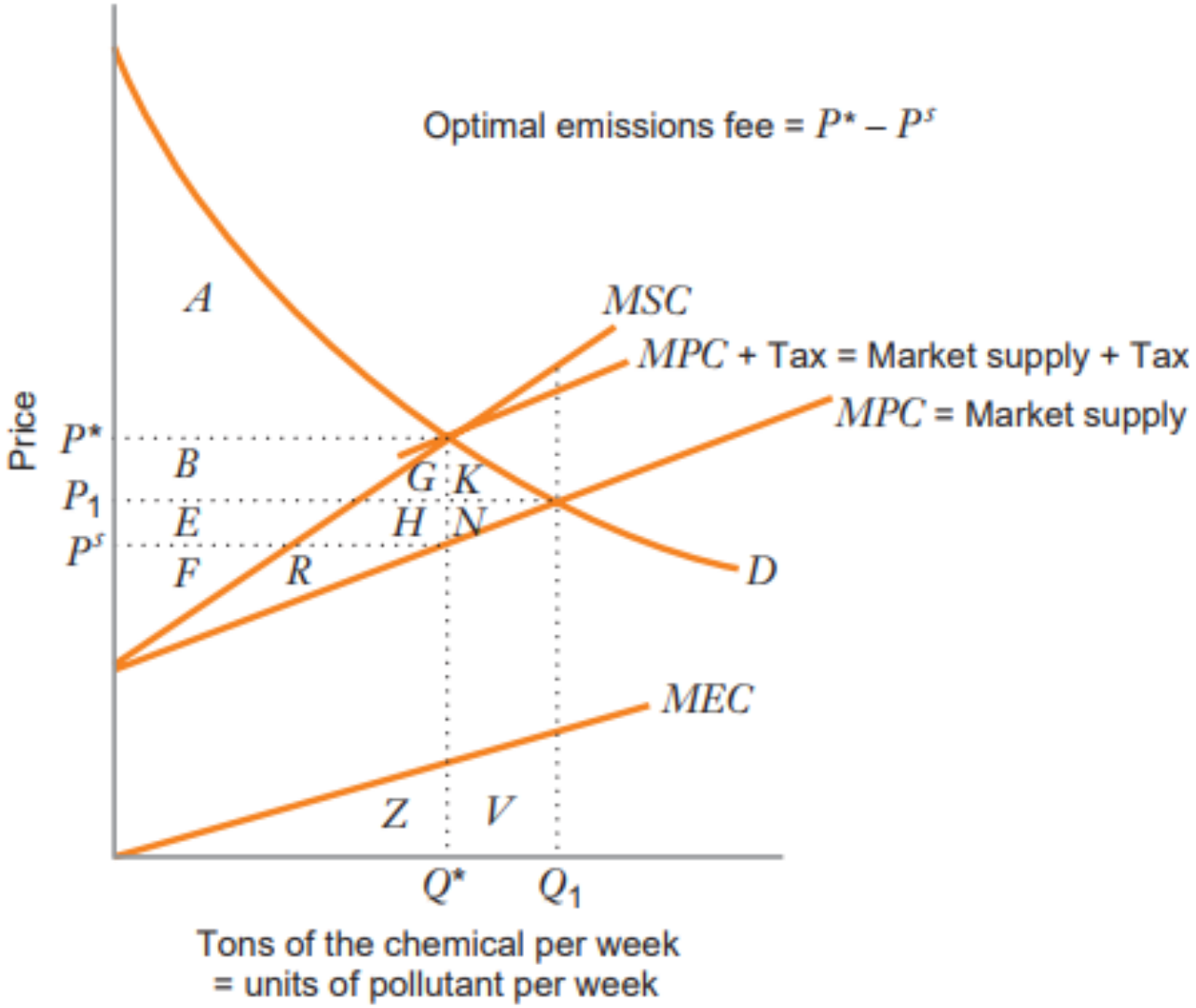


Exercise: Welfare analysis of negative externalities



	Equilibrium (price = P_1)	Social Optimum (price = P^*)	Difference between Social Optimum and Equilibrium
Consumer surplus			
Private producer surplus			
−Cost of externality			
Net social benefits (consumer surplus + private producer surplus − cost of externality)			
Deadweight loss			

Exercise: Correcting externalities and optimal tax



	Equilibrium (with tax)
Consumer surplus	
Private producer surplus	
−Cost of externality	
Government receipts from emissions tax	
Net social benefits (consumer surplus + private producer surplus − cost of externality)	

Numerical Exercise

Consider a variation of the chemical manufacturing example. Suppose the inverse demand curve for the chemical (which is also the marginal benefit curve) is $P^d = 24 - Q$, where Q is the quantity consumed (in millions of tons per year) when the price consumers pay (in dollars per ton) is P^d.

The inverse supply curve (also the marginal private cost curve) is $MPC = 2 + Q$, where MPC is the marginal private cost when the industry produces Q.

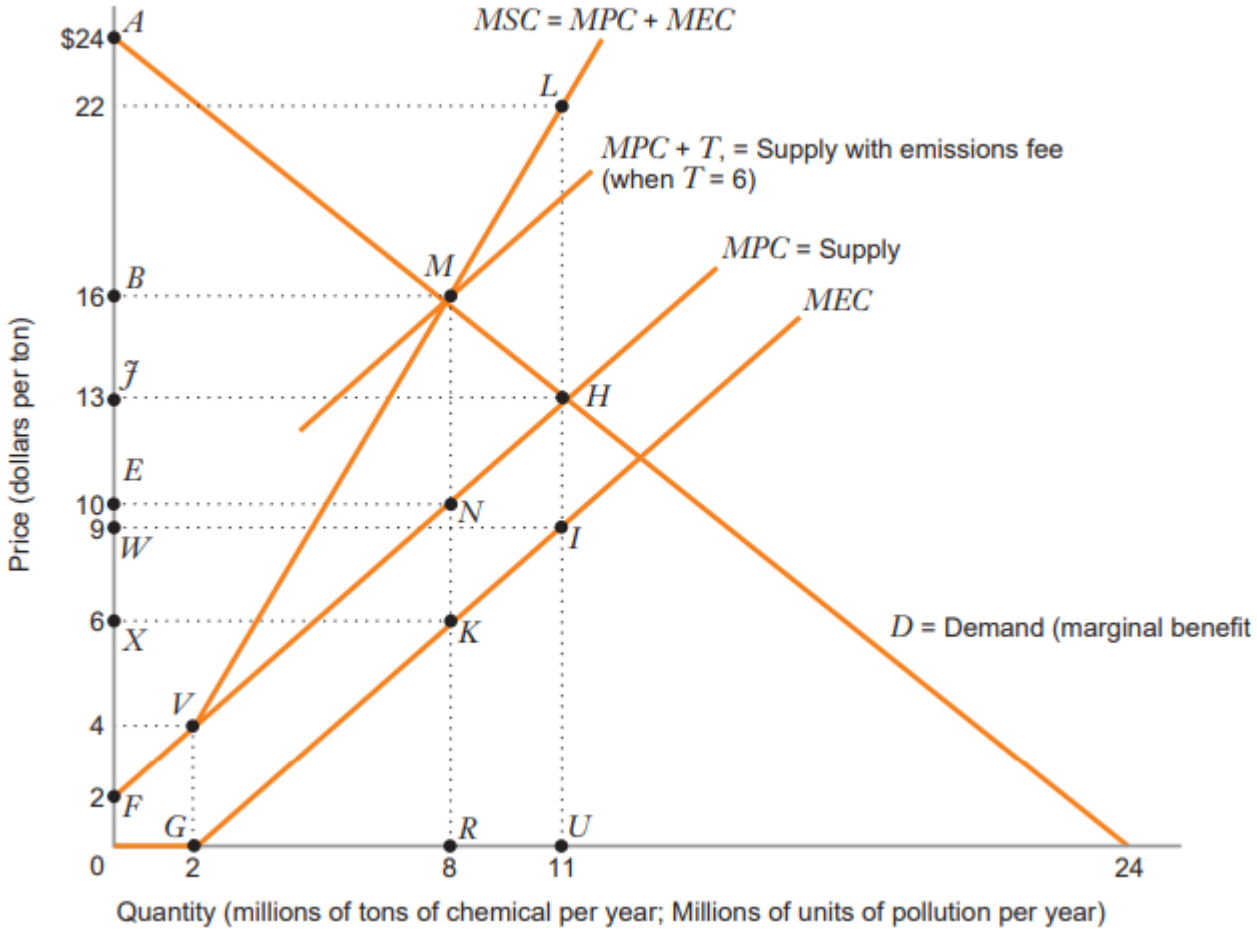
The industry emits one unit of pollutant for each ton of chemical it produces. As long as there are fewer than 2 million units of pollutant emitted each year, the external cost is zero. But when the pollution exceeds 2 million units, the marginal external cost is positive. The marginal external cost curve is

$$MEC = \begin{cases} 0, & \text{when } Q \leq 2 \\ -2 + Q, & \text{when } Q > 2 \end{cases}$$

where MEC is marginal external cost in dollars per unit of pollutant when Q units of pollutant are released.

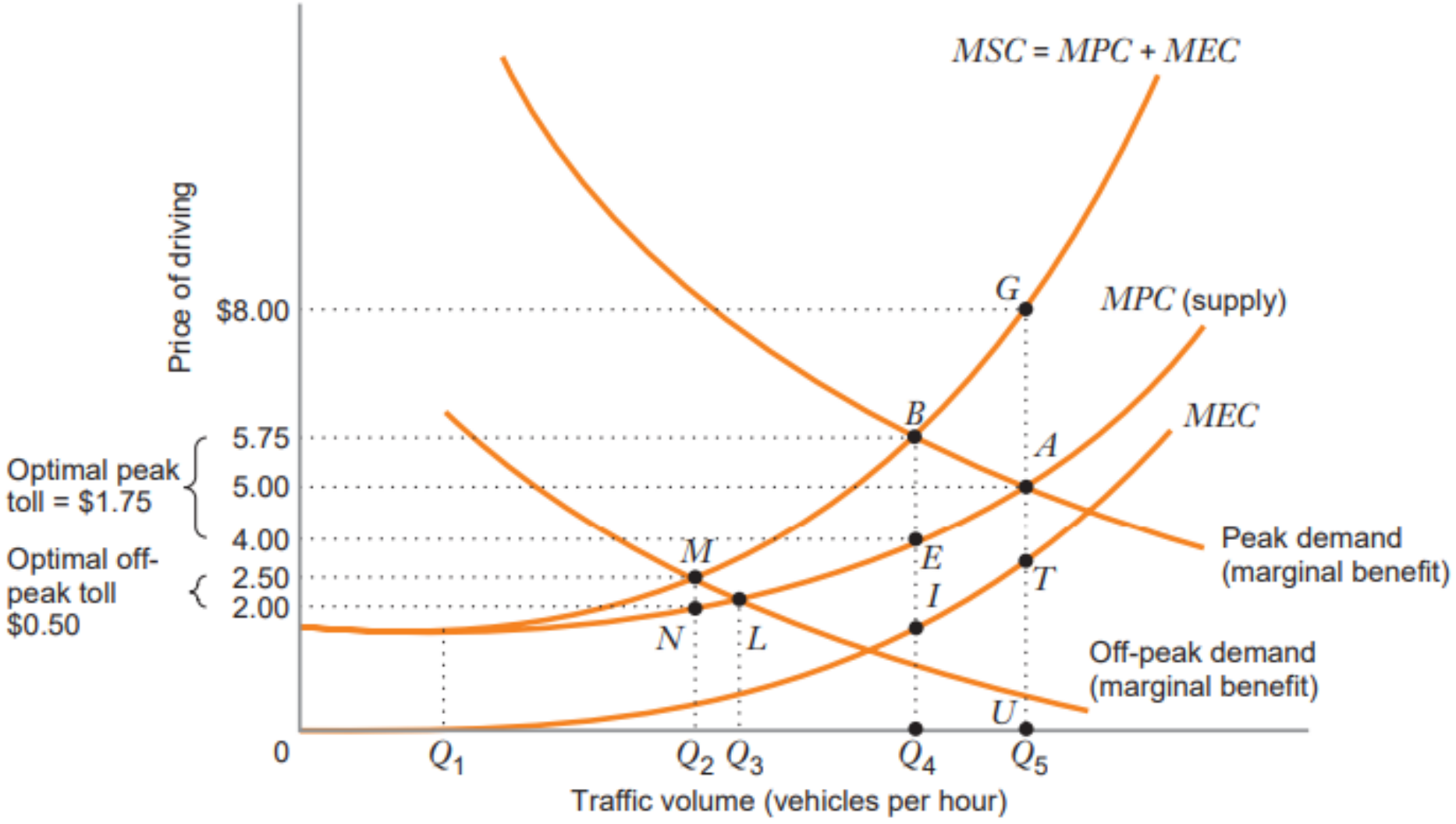
Also suppose the government wants to use an emissions fee of $\$T$ per unit of emissions to induce the market to produce the economically efficient amount of the chemical.

Extra example

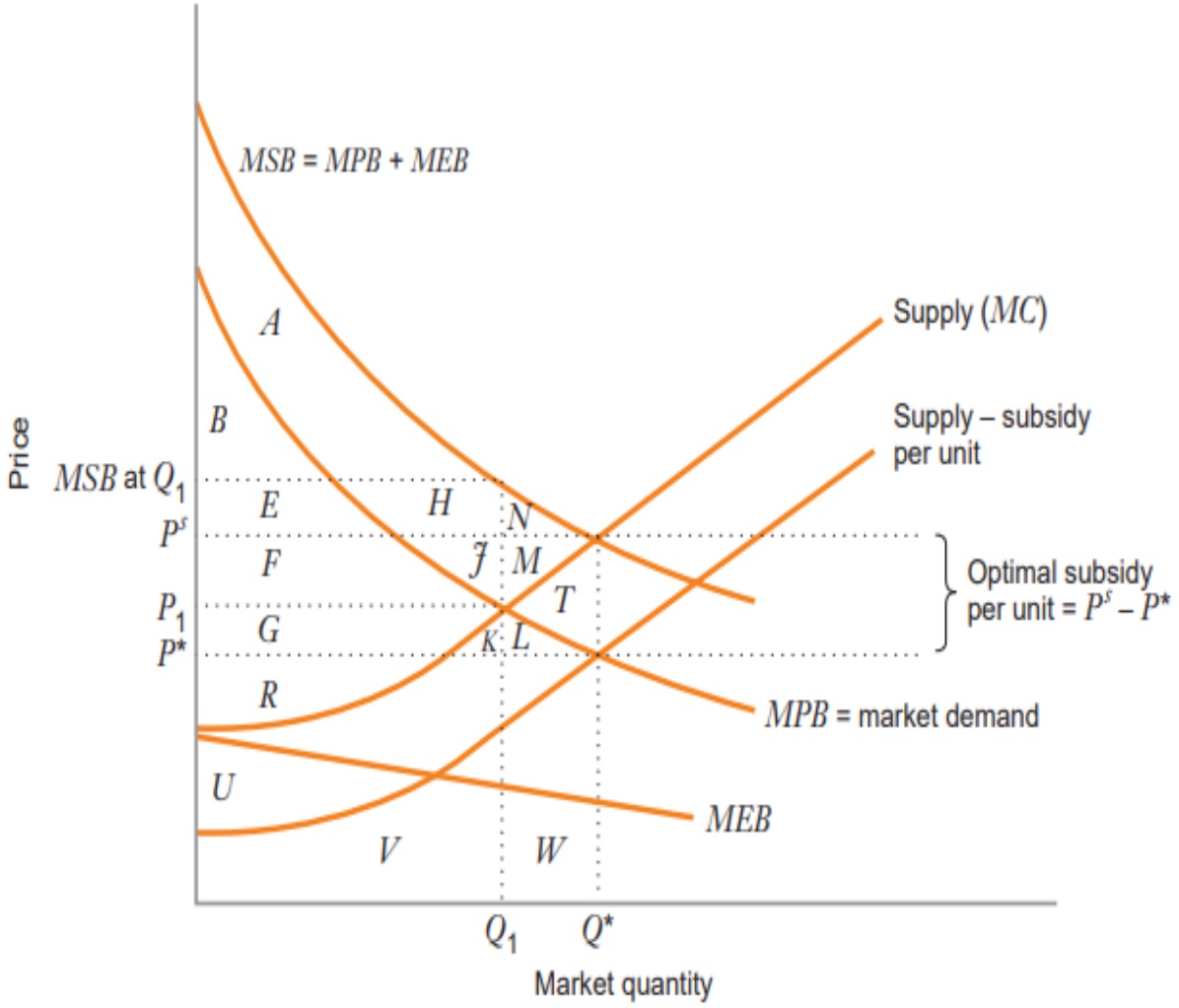


	No Emissions Fee	Emissions Fee of $6 per Unit
Consumer surplus	*AJH* $60.5 million	*ABM* $32 million
Private producer surplus	*FJH* $60.5 million	*FEN* $32 million
−Cost of externality	*−VLH (= −GIU)* −$40.5 million	*−VNM (= −GKR)* −$18 million
Government receipts from emissions fee	zero	*ENMB* $48 million
Net social benefits (consumer surplus + private producer surplus − cost of externality + government receipts)	*AMVF − MLH* $80.5 million	*AMVF* $94 million

Extra example: Congestion pricing



Positive Externalities and subsidy. (just for reference, no need to study)



	Equilibrium (no subsidy)	Social Optimum (equilibrium with subsidy)	Difference in Benefits between Social Optimum and Equilibrium with No Subsidy
Private consumer surplus	$B+E+F$	$B+E+F+G+K+L$	$G+K+L$
Producer surplus	$G+R$	$F+G+R+J+M$	$F+J+M$
Benefit from externality	$A+H+J$	$A+H+J+M+N+T$	$M+N+T$
−Government cost from subsidy	zero	$-F-G-J-K-L-M-T$	$-F-G-J-K-L-M-T$
Net social benefits (private consumer surplus + producer surplus + benefit from externality − government cost)	$A+B+E+F+G+H+J+R$	$A+B+E+F+G+H+J+M+N+R$	$M+N$