Role of Backstop

Meaning of Backstop:

We all know that as the demand for a resource that is in limited supply increases, it will kick in a process that results in the exploitation of other alternative resources to meet human needs. For instance, as the demand for oil increases even as its available supply decreases, this will cause the price of oil to shoot up and push businesses to look for alternative sources of energy. This alternative source of resources is known as "backstop". So, backstop is nothing, but the substitute resources to exhaustible resources.

Optimal depletion and Price of Non-Renewable Resources in presence of Backstop

So far, we have considered optimal depletion of an exhaustible resource, we implicitly ruled out availability of any substitute or backstop. But it may happen that a substitute resource, possibly a renewable resource, is available at a constant MC. For example, a backstop of oil or natural gas may be solar substitute. Then the question arises what would be the optimal depletion rule in these circumstances?

Suppose that this alternative, or "backstop" resource, which is perfectly substitute of the non-renewable resource, can be supplied at some high cost but in fairly large quantities so that it is inexhaustible for all practical purposes. Since the backstop has a virtually unlimited supply, its price will be just sufficient to cover its marginal extraction cost. Implicitly, backstop technologies are assumed to be renewable. Ethanol fuel from renewable corn and sugar is frequently seen as a backstop for petroleum. In the presence of a backstop, there is a ceiling on the net price of the non-renewable resource. In theory, as soon as the price of the non-renewable resource just exceeds the price of the backstop, the former will be priced out of the market and the demand would be entirely satisfied by the latter resource. (In effect, the price of the backstop is like the vertical intercept on the linear demand curve for the non-renewable resource.) The overall result is the same as in the case with multiple sources of the same non-renewable resource. The net price of the non-renewable resource will rise at the interest rate till it is completely exhausted. Exactly at that instant the net price would be equal to the price of the backstop and production would shift from the non-renewable to the backstop resource. It is easy to argue that in the absences of a backstop, the non-renewable resource would be depleted at exactly the time when production shifts to the backstop. Suppose this is not the case and there are some remaining reserves of the non-renewable resource when its price rises to

that of the backstop. Then the resource owner would be unable to sell the resource on the market since the net price necessary to cover the scarcity rent would exceed the price of a cheaper substitute. The only option is to sell the resource at an earlier and lower price. However, this would increase the supply in the market and the net price would fall. In fact, the price would decline to a level such that when it rises at the interest rate the resource is exhausted at the price of the backstop. A similar argument emerges in the situation where the resource is exhausted before its price reaches the ceiling set by the backstop. In this case, there is a large excess demand which would bid up the price for the resource. The profit-maximizing resource owner would then hold back some reserves to sell at the future higher price and the production horizon would be extended. The above example assumes the supply curve for the backstop is horizontal at a price just sufficient to cover its marginal extraction cost. This assumption is not necessary. It is entirely possible that the price of the backstop is rising slowly. As long as the backstop price is rising slower than the interest rate, then the price trajectories for the non-renewable resource and the backstop will intersect at some point. At that point, the price of the backstop will become the ceiling for the price of the non-renewable resource and the latter resource will be completely depleted. From that point on, the market will be completely supplied by the backstop. Figure 1shows the intersection of the price trajectories for the non-renewable and backstop resources, where Pnr indicates the price of the non-renewable resource, Pb indicates the price of the backstop, and Tnr indicates the depletion of the non-renewable resource.

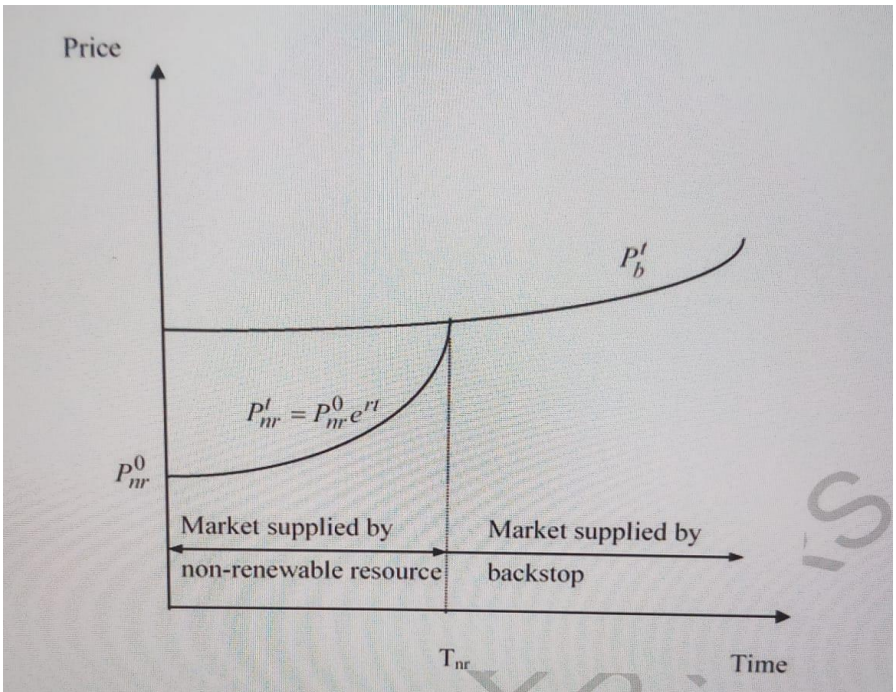

Figure 4: Impact of Backstop Resource