Run 5-1 (Figure 5-25) illustrates the standard run from a 200-year simulation of the nonrenewable resource sector shown in Figure 5-24. Industrial capital IC and industrial output IO grow from 1900 until 2025, when the depletion of nonrenewable resources reverses this growth trend. The declining grade of nonrenewable resources requires that a larger and larger fraction of the capital base be allocated to resource processing activities. The capital costs of obtaining resources do not have to increase very much to cause a reduced growth rate of industrial capital. For example, if the fraction of capital allocated to obtaining resources FCAOR were to increase by 10 percent per year, and the annual net reinvestment (investment rate less depreciation rate) were less than 10 percent per year, then usable (processed goods) output would fall and total investment in industrial capital would begin to fall. The initial static resource index in the year 1900 of this run exceeds 3,500 years. In 1970 the static index has declined to 250 years because of a great increase in the rate of resource consumption. By the year 2025, only 55 years after 1970, the exponentially growing consumption rate has depleted the initial resources by about 50 percent. The costs of obtaining resources are rising and reversing the process of economic growth because of the necessary shift of capital to obtaining resources.

During a short period before the year 2020, both industrial output IO and the fraction of capital allocated to obtaining resources FCAOR are rising. The rise in the latter may occur unnoticed during this time, for the rate of increase in FCAOR is less

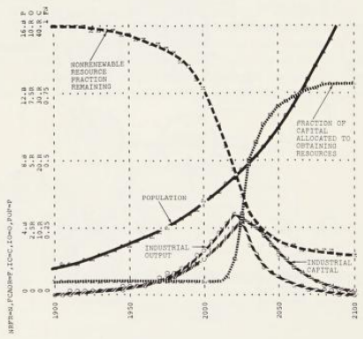

Figure 5-25 Run 5-1: standard run for the nonrenewable resource sector

than the rate of growth in capital; thus total output is increasing. Because of the continued exponential growth in the consumption of resources, however, this rate of increase in FCAOR eventually exceeds the rate of economic growth, thereby slowing the rate of reinvestment of industrial capital. By the year 2020 the rate of shift of capital to obtaining resources is large enough to cause industrial output IO to decline.

The method of estimating the initial value of nonrenewable resources was described earlier in this chapter. It was pointed out that the value used in the model is a reasonable estimate but one subject to much uncertainty. To test the sensitivity of the sector's behavior to this estimate, the initial value of nonrenewable resources was doubled in Run 5-2 (Figure 5-26). In this run, industrial capital IC increases for a longer period of time and reaches a higher value before turning downward. The maximum value reached by IC is almost twice as high as in the standard run, Run 5-1 (Figure 5-25). The peak, however, occurs only about 20 years later than in the standard run. Doubling the initial supply of nonrenewable resources in 1900 lengthens the period of capital growth by only 20 years.

This apparent insensitivity to the initial value of resources is understandable when one considers the factors governing the usage rate during the first hundred years of the run. Of primary importance is the relationship between the exponentially growing capital stock and the exponentially growing population. Exponential growth in industrial capital IC causes industrial output IO to grow exponentially, given a constant capital-output ratio and a stable fraction of capital allocated to obtaining

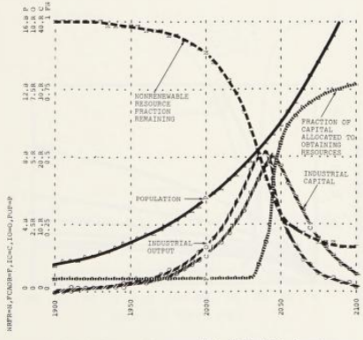

Figure 5-26 Run 5-2: Behavior of the sector with double the initial value of nonrenewable resources