To solve for the new brake power of a centrifugal pump undergoing changes in operational speed, impeller diameter, and fluid density, we must apply the foundational rules of fluid mechanics known as the **Pump Affinity Laws**. Centrifugal pumps are dynamic machines that impart kinetic energy to a fluid via a rotating impeller, which is subsequently converted into pressure energy.

In maintenance and field operations, engineers do not buy a brand-new, scaled-up pump housing just to make a minor system adjustment. Instead, they take the existing impeller and physically machine down its outer diameter on a lathe—a process called **Impeller Trimming**.

When an impeller is trimmed inside a fixed casing, the geometric boundaries change completely:

1. The width of the impeller exit channels (b) remains completely unchanged.
2. The internal casing area stays exactly the same.

Because of this, the scaling behavior shifts from a three-dimensional volume change to a simplified two-dimensional area change:

$$\frac{BP_1}{BP_2} = \left(\frac{N_1}{N_2}\right)^3 \left(\frac{D_1}{D_2}\right)^3 \left(\frac{SG_1}{SG_2}\right)$$

$$\frac{60\ kW}{BP_2} = \left(\frac{350\ rpm}{660\ rpm}\right)^3 \left(\frac{155\ mm}{120\ mm}\right)^3 \left(\frac{1.03}{0.80}\right)$$

$$BP_2 = 145.00\ kW$$

This problem is intended for an idealized academic illustration only. Physically we can trim an impeller from 155 mm down to 120 mm on a lathe, but **practically and hydraulically, it is a bad engineering decision.** Trimming that much diameter violates standard industrial limits and will severely degrade the pump's performance.