Appendix 1

Additional information to the proposed JCM methodology
"Installation of inverters to distribution pumps in water treatment plant"
on setting an equation to calculate ECR of reference pump

1. Market of distribution pumps in Cambodia

Research on the four water treatment plants of the largest water supply authority in Cambodia has been conducted. Based on the research and an interview with water supply authority, it is found that most of pumps installed are manufactured by a Japanese pump manufacturer, Company A and only a part is by Company B (also Japanese pump manufacturer). Detailed market share is not obtained, but water distribution pumps can be purchased from not only Japan but also from manufacturers of Europe, China and Korea.

2. Determination of equation to calculate ECR of reference pump

Although water distribution pumps can be purchased from not only Japan but also from manufacturers of Europe, China and Korea, Japanese made has a good reputation in terms of pump efficiency. Therefore, actual measurement of electricity consumption at various levels of operational load has been conducted for Japanese pumps.

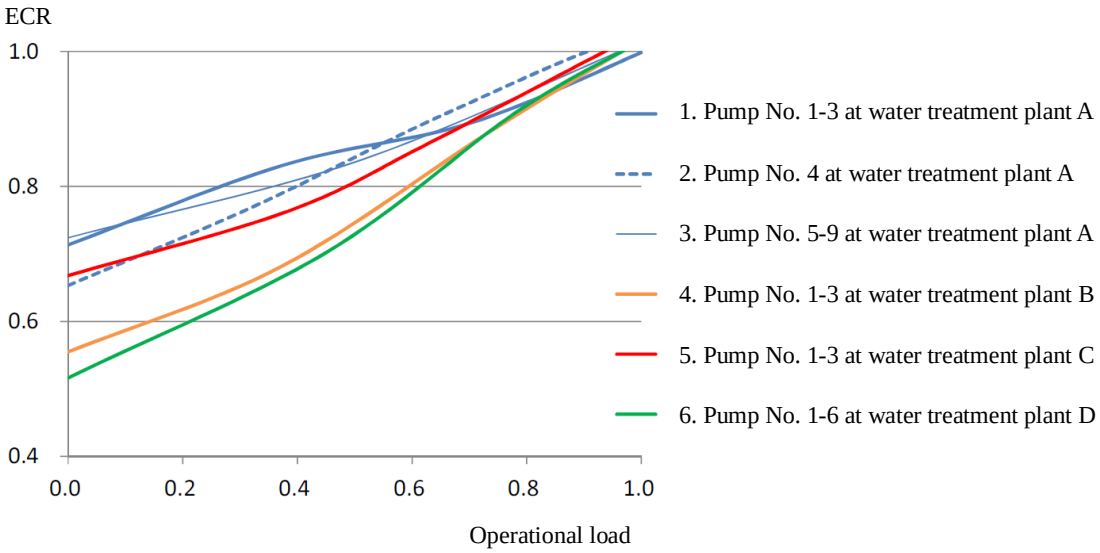

Figure 1: Relationship between ECR and operational load of distribution pumps

Source: Based on the research conducted by the methodology proponent

Sample No.3 is the oldest pumps installed in 1995, and sample No.1 was installed in 2002. Sample No. 4 and No.5 were installed in 2007. Sample 6 is the newest pumps installed in 2012.

Relatively new pumps show less electricity consumption (ECR) than old ones at the same operational load. Therefore, the most conservative sample data set (Sample No.6) is used to determine an equation to calculate ECR of reference pump.

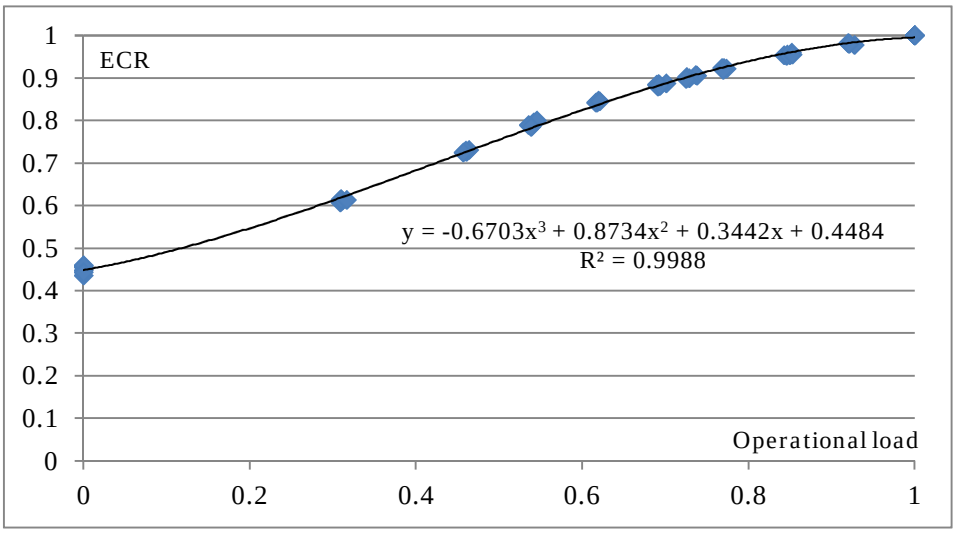

Figure 2: Equation to calculate ECR from operational load of pump

Theoretically, power consumption of pump is proportional to the cubes of its rotating speed and water flow is operational to the rotating speed of pump. Therefore, a cube equation derived from approximation analysis is rational. The coefficient of determination (R^2) of the equation is also quite high.

An equation to calculate ECR of reference pump is determined as follows;

$$y = -0.6703x^3 + 0.8734x^2 + 0.3442x + 0.4484$$