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ELECTRIC OR DIESEL: SELECTION CRITERIA SHOULD INCLUDE OPERATING COSTS FOR TEMPORARY BYPASS PUMPING

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For decades, the standard in temporary bypass pumping has been diesel-powered portable pumps, and for good reason: Their flexibility and the ability to set them up anywhere has made them the go-to choice. But with fluctuating fuel and rising servicing costs, as well as growing interest in cleaner, greener sources of power, electric-drive pumps can be a viable alternative for project needs, especially for longer-term projects.

While there are many elements that go into the contract selection process, most decision-makers primarily focus on the overall cost of pump rental, rather than looking at the cost of pump rental plus anticipated operating costs. This approach gives a much more comprehensive picture of the total cost considerations, allowing for more accurate budgeting, and it can help avoid unanticipated operating cost overruns during the length of the project.

Taking this more comprehensive approach is a bit of a paradigm shift for the industry, but it is one that is beneficial in the long run. While one option may be more cost competitive from a rental standpoint, calculating and including the anticipated operational costs as part of the bid process provides a more accurate view of total rental costs.

There are some conditions in which electric-drive pumps may not be a cost-competitive alternative to diesel-powered bypass pumps. Two factors that should be examined up front are existing access to power and/or the cost of any necessary electrical drop as well as the anticipated rental duration. On average, a project lasting less than three months is not likely to provide enough savings, when compared to a diesel bypass pump, to offset the cost of an electrical drop.

In most instances, the rental cost differential between diesel and electric driven portable pumps is negligible. With that knowledge, calculating the opeating costs of a temporary application can determine if the project is a good candidate for the use of electric drive pumps versus diesel. To do that requires some specific analysis and information.

Step one: Know the operating conditions

To correctly estimate operating costs for a temporary bypass project, the first step is to have a thorough understanding of the proposed operating conditions, specifically the required flow and head, also known as the duty point of the application.

For example, as shown in Fig. 1, an 8-inch portable pump on a sewer bypass application will be operating at 1,500 gallons per minute (GPM) and pumping against 80 feet of total dynamic head (TDH). This application uses a specific gravity of 1, as water is being pumped. A common conversion factor of 3960 is used in the calculation. Using this calculation, on the performance curve for this pump, that would mean an efficiency of about 61%. Upon completion of the calculation, the impeller would need approximately 50 horsepower of torque from the drive source.

Formula:	Flow	x	Head	÷	Eff.	÷	3960	=	HP
	1500	x	80	÷	.61	÷	3960	=	**50 HP**

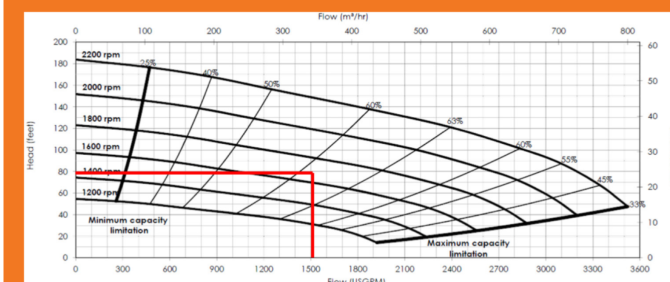


Fig. 1: Formula for and example of calculating horsepower at an operating point.

Step Two: Converting needs to operating costs

Once fuel consumption is established, it is easy to estimate likely operating costs for both a diesel and electric-drive pump application.

Using the same example from Step One, the formula, as shown in Fig. 2, to calculate diesel fuel consumption is: 50 HP x .05 (a conversion factor of horsepower to fuel consumption per hour) = 2.5 gallons of fuel/hour of operation x $3 (cost of a gallon of diesel fuel) = hourly operating rate of $7.50.

It's important to note that this figure does not include service costs. Industry standards recommend service for every 250 hours of run time. For longer-term projects, this can add significantly to the operating costs.

Returning to the same example, a similar equation is used to calculate equivalent operating costs for an electric-drive pump, as shown in Fig. 2: 50 HP x .746 (a conversion factor that converts to kWh) = 37.3 kW/hr x $.10 (average cost of kWh) = hourly operating rate of $3.73.

Diesel cost: 50 HP x .05 = 2.5 gal/hr. x $3 = **$7.50/hr.**

Additional cost considerations:
Diesel engine servicing

Electric cost: 50 HP x .746 = 37.3 kw/hr. x $.10 = **$3.73/hr.**

Additional cost considerations:
Electrical drop costs

Fig. 2: Examples of calculating fuel consumption costs for diesel and electric pumps.

As with the diesel pump calculation, this amount does not include an important cost consideration: getting electric power to the pump, also known as the drop cost. Though the projected operating costs of electricity will always be less than diesel fuel, the drop cost can eliminate that cost advantage. Depending on where the nearest power source is and where the pump will be located, the cost can be significant. That amount also needs to be calculated and included in the operating costs.

One advantage that electric-drive pumps offer over diesel alternatives is that they also reduce the overall carbon footprint of a project, which may be a factor in the bid process. Depending on the project design, some electric pumps are able to provide the capacity that formerly required multiple diesel-powered pumps.

Step Three: Calculating operating costs over time

Returning to the example, in this application, as shown in Fig. 3, the pump is likely to run 12 hours a day and the drop cost of getting electricity to the pump is $5,000/month. Knowing these factors, it is then possible to obtain an accurate comparison between the two options.

System parameters: Pump operates 12 hours/day on average
Electric drop cost: $5,000
Diesel calculation: $7.50/hr. x 12 hrs. x 60 days = $5,400
Electric calculation: $3.73/hr. x 12 hrs. x 60 days = $2,685 + $5,000 = $7,685

	2 Months	4 Months	6 Months
Diesel costs:	**$5,400**	$10,800	$16,200
Electric costs:	$7,685	$10,371	**$13,056**

Fig. 3: Example comparison of diesel vs. electric costs.

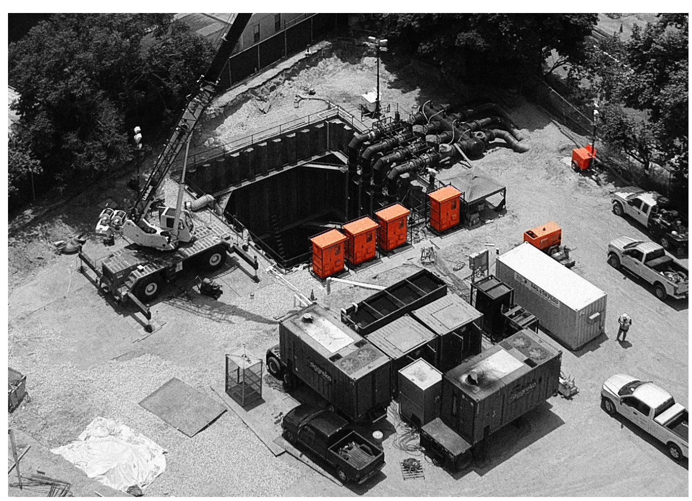
In this example, and even with standard diesel servicing costs factored in, the operating costs for diesel versus electric-drive pumps are less at the two-month period. But as the duration of this application continues over time, the cost advantage begins to diminish, and the electric-drive option becomes more cost effective, even when the drop cost is included.

Again, it's important to note that rental cost differentials between diesel vs. electric powered pumps are negligible, further emphasizing the importance of calculating operating costs for the duration of the project.

What may be an option, and one that is being incorporated into many projects, is a combination of the two types of pumps on site. Often, an electric-drive model is chosen as the primary pump as it is used most during the project, and a diesel-powered pump is designated as a dedicated spare to provide the needed redundancy for sewerage pumping. There are many reasons why a project could be engineered this way, and the cost savings of integrating electric bypass pumps becomes an additional advantage.

Case Study: Hybrid emergency pump solution aids city of Los Angeles

With the age of its municipal sewer system, the city of Los Angeles continually addresses issues with deteriorating, leaking sewer lines. But when a section of the North Outfall Sewer in downtown Los Angeles threatened to collapse, emergency services were needed, including a temporary sewer bypass system.



A bypass project in Los Angeles required the construction of a 20-foot suction pit, which was excavated over the 35-foot deep sewer, where electric submersible sewage pumps were staged.

The project required the construction of a 20-foot suction pit, which was excavated over the 35-foot deep sewer, where four Flygt 3531, 335HP, 24-inch electric submersible sewage pumps were staged. Due to the depth of the suction pit, surface mounted diesel-powered portable pumps were eliminated from consideration due to priming suction lift limitations. Plus, the electric submersible solution allowed for the installation of a 24 million gallons per day (MGD) pumping system in a small working area.

The Xylem-designed system moved a peak flow of 40 MGD, using four Flygt 3531 electric submersible pumps. Two pumps were primary and two pumps were dedicated standby. Two diesel generators were set up to power the pumps, one to power the two submersible pumps and one to act as standby.

The temporary bypass setup was anticipated to operate continuously for nine months, resulting in cost savings by integrating a hybrid approach of electric and diesel-powered options.

Case Study: Temporary bypass project uses electric pumps to handle real-time use fluctuation

When a temporary bypass solution was needed during upgrades to an existing lift station in Monroe County, New York, a Xylem-designed lift station relied on a primary 8-inch Godwin Dri-Prime CD225M electric pump and a submersible Flygt N 3301 electric submersible pump as the primary pumps for this bypass, with a Godwin Dri-Prime CD300M 12-inch diesel pump as a backup.

A temporary bypass system, which included a Godwin Dri-Prime CD300M 12-inch diesel pump and Godwin Dri-Prime CD225M 8-inch electric pump, operated continuously for three months during equipment upgrades at the John Street lift station in Monroe County, New York.

This particular project required a bypass system that could move a flow of 12 MGD, as this lift station not only serves a large residential community but also the nearby Rochester Institute of Technology campus, resulting in significant fluctuations ranging from a peak flow of 12 MGD, when the college is in session, to a much lower peak flow of 1.5 MGD during the summer when the students are away. Additionally, the decision to incorporate electric pumps rather than diesel alternatives also reflected a need to reduce the decibel level of the project, as it was located near student housing.

Since the pumps were to run continuously throughout the duration of the project, electric pumps offered significant cost savings over diesel pumps. Other factors, such as efficiencies and site conditions, also favored the selection of electric pumps.

Case Study: Existing footprint limitations creates new opportunities for savings

The 30-year-old sewage pump station in Onondaga County, New York, was in need of a major upgrade. Project plans called for a bypass system that could move a peak flow of 30 MGD. An initial project design called for the use of existing pumps to carry this capacity, but a design review showed that these pumps only provided the capacity to bear 19 MGD.

A combination of diesel pumps and electric submersible pumps allowed the temporary bypass project in Onondaga County, New York, to operate at maximum efficiency, offering a flexible solution for fluctuating wastewater flow levels.

Any updated solution faced a restriction: It had to fit in the existing footprint of the original pumps and the compact substation, which is located in a high-visibility area near the New York State Fairgrounds.

Project designers used two Flygt N 3312 pumps, which were able to plumb into the existing piping system, and three Godwin Dri-Prime CD300M pumps, which are lower-decibel alternatives to diesel bypass pumps. Diesel pumps served as backup for the project.

More importantly, the project requirements included a need for the contractor and project owner to remotely and continuously monitor and control the six-month project rather than relying on manned pumps. This allowed the project manager to remotely adjust the pumps to match any use fluctuations. Ultimately, the combination of these factors, along with the use of electric bypass pumps over conventional diesel-powered pumps, resulted in a cost savings of nearly $57,000.

Calculating operating costs upfront provides an accurate cost projection

It's important to work with a trusted pump rental company that can provide accurate data, a comprehensive bid that includes both rental and fuel consumption costs and reliable equipment to meet the needs of a project. No two projects are completely alike, and the right pump rental partner can help customers create the right solution.

Doing the work upfront to calculate total rental and operational costs also will provide an accurate projection for budgeting purposes and minimize any unexpected operating cost overruns at the conclusion of the work.

Pete Snow is a training coordinator with a 25-year career as a corporate trainer, first with Godwin Pumps of America Inc., and after 2010, with Xylem Inc. Snow has instructed employees, distributors and customers both domestically and around the world about the Godwin Dri-Prime pump, basic pump hydraulics and portable pump system design. Prior to his work with Xylem, Snow was a short- and long-range planner for refinery maintenance and shutdowns at the Mobil Oil facility in Paulsboro, New Jersey.

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1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

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For more information on how Xylem can help you, go to www.xylem.com

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