Steam Leak – Repair Leaks in Lines and Valves (Arc 2.2133)

(The analysis below was extracted from one of the assessment reports by the Clemson University Industrial Assessment Center (IAC). This is only an example recommendation and hence, not all the background information and sources for numbers are included here.)

Est. Total Cost Saving	= ***$3,542/yr***
Est. Implementation Cost	= ***$2,040***
Simple Payback Period	= ***6.9 months***

Recommended Action:
Repair the active steam leak located in the open courtyard between buildings.

Background:
During the energy assessment this steam leak was very prominent in the courtyard. It is located approximately 20 feet off the ground, with no immediate access. Due to the size of the steam flume (approximately 5 feet) and no way to safely measure the hole - Assumed a minimum of 1/8" (based on other leaks) and a pressure of 100 psi. According to the reference table a leak of this size equals 41 pph of steam loss. Conversion to btu is by a factor of 1194 (Sciencing.com).

= .04895 BTUs /hr. × 8760 (hrs per yr)/1.000.000 = 430 MMBtu

Engineering equation – a variation on the Napier formula for determining flow through an orifice: compensated for flow through a non-circular orifice.
Steam loss = C (compensate for imperfect orifice) × P_a × Diameter^2 × cost of steam × time (Min/hour/day/year)

Where:

C	= 22.88 (Constant - compensates for imperfect orifice)
P	= Pressure (absolute) = 114.69 psia
D	= Diameter squared (inches) = 1/8"×1/8" = .125 × .125 = .015625 inches
Cost of steam	= $0.4085 cents/per hour
Time – 24 hours	= $9.84 (Cost per day)
Month – 30 days	= $295.20 (Cost per month) × 12 months = $3,542/yr.

Note: Steam table final number is larger due to the assumption the leak gets bigger over time.

Implementation Cost:
Assumptions:
1. Steam leak can be repaired in one-day outage.
2. Steam to this line can be isolated or vented so pipe/trap can be accessed Safely.
3. On-site scissors lift is operational and fall protection is available for Mtce personnel.

Steam Outage = Four-hour system isolation/shutdown – Est. $1500
Replace trap, steam line, or both – Est. 2 hr. x 2 laborers x $30/hr. = $120.00

Material – Pipe, tools, fall protection, scissors lift estimate = $420.00

Implementation Cost (IC) = Outage ($1,500) + Labor ($120) + Material ($420)

IC = $2,040

Simple Payback Period:

The *simple payback period, SPP*, is the time required to pass before the estimated total cost savings equal the estimated implementation cost, and is calculated by:

$$SPP = \frac{IC}{TCS} \times 12\ months/year$$

$$SPP = \frac{\$2{,}040}{\$3542/yr.} \times 12\ months/year$$

SPP = 6.9 months

References:

1. Plant Engineering – Best Practices Steam leak table – used to calculate the one-year cost of this leak.
2. Sciencing.com – How to convert steam to BTU – used to convert pounds per hour to MMBTu