

Localized solutions for installation of PSA plant

A case of Ram Sagar Mishra Hospital in Lucknow, India

Since March 2020, when the northern state of Uttar Pradesh (UP), India reported its first case of COVID-19, the state government enhanced measures to strengthen the health infrastructure to meet the anticipated demand for healthcare services and added 52,000 beds in the COVID-19-designated hospitals. The state government classified the hospitals into three tiers. Level-1 facilities called the COVID-19 Care Centers were capacitated to treat very mild, mild, and suspected cases. Level-2 facilities, also called COVID-19 Health Centers, were earmarked for clinically moderate patients, and Level-3 facilities were dedicated COVID-19 hospitals to provide comprehensive care to severe and critical patients. Of the 52,000 additional beds, 17,000 beds were added by the Department of Health and Family Welfare by increasing 10,000 beds in Level-1 facilities, 5,000 beds with oxygen in Level-2 facilities, and 2,000 beds with ventilators in Level-3 facilities. The Department of Medical Education added the remaining 35,000 beds in Level-1, Level-2, and Level-3 facilities under its administration.

Besides the loss of human lives during the unprecedented surge in COVID-19 cases during the second wave between April and June 2021, the health systems in UP, like many states in the country, also experienced disruption in medical oxygen supply chain. This led to severe shortage of medical oxygen. The deficit was felt in urban agglomerations, as well as in small towns and villages where the health infrastructure was already vulnerable.

PATH's technical assistance to UP

PATH, with support of leading national and global philanthropic foundations, stepped up to provide technical assistance to the state in tracking the gap between demand and supply of oxygen, and installing and commissioning pressure swing adsorption (PSA) oxygen generation plants. PATH also supported the civil work required to prepare the site for PSA plants. Reinforcing the organization's commitment to systematic and coordinated improvement in providing life-saving commodities, in this case, medical oxygen, to patients, PATH worked with the government, non-governmental organizations, and private stakeholders engaged in PSA plant supply, distribution, installation, administration, and equipment maintenance.

In addition to assisting the state government and in installing and commissioning the PSA plants procured by them, PATH also proposed installation and commissioning of ten PSA oxygen generation plants in

the state. These plants were procured with support from the Bill and Melinda Gates Foundation (BMGF).

“PATH was first approached by the Department of Infectious Diseases to assist in understanding the requirement of oxygen and its calculation. As the pandemic evolved, PATH's support to the Government of Uttar Pradesh expanded to timely and effective installation of PSA plants across the state. Despite a lot of operational challenges, our team was at the forefront of public health catastrophic warzone, working shoulder to shoulder with the government.”

Dr. Sachin Gupte
State Lead – Uttar Pradesh, PATH

However, as the state government became occupied with procuring, installing, and commissioning PSA plants allocated to it under Prime Minister's Citizen Assistance and Relief in Emergency Situations (PM CARES) Fund, it took PATH several rounds of strategic engagements with the state government officials to identify the sites for the ten PSA plants that PATH would procure and install. PATH received the approval from the state government in May 2021 through a government order. The order enlisted the ten facilities and their locations. One of the ten approved sites was the 100-bedded Ram Sagar Mishra (RSM) Hospital at Bakshi ka Talab in Lucknow.

“Two” many PSA plants at RSM Hospital

RSM Hospital, a 100-bedded combined hospital in Sarhamau, Bakshi ka Talab, is around 25 kilometers from the heart of Lucknow city, the capital of Uttar Pradesh. When COVID-19 hit Lucknow, it witnessed a high burden of patients. As a result, the state government designated RSM hospital as a Level-2 hospital. Besides having separate areas for suspected and confirmed cases and measures to ensure that the two groups do not mix under any circumstances, RSM Hospital, as a Level-2 facility, was expected to have beds with assured oxygen support and mapped with one or more Level-3 facility, i.e., a dedicated COVID-19 hospital.

Due to its Level-2 status, RSM Hospital was allocated a 1,000 liters per minute (LPM) capacity PSA plant through the PM CARES Fund. The state government further allocated a second PSA plant of 750 LPM capacity to this facility via a letter from the Special Secretary to PATH. As a result, the 100-bedded facility now had two PSA plants allocated to it, with a total capacity of 1,750 LPM.

Neither hearth nor home for the PSA plant

RSM Hospital had an existing medical gas pipeline system (MGPS), which was connected to only around 20 beds through a manifold system. The hospital authorities, after deciding to construct a new manifold system and extend the MGPS to 91 ICU and oxygen beds in the facility, sent an application to the state health officials to request financial approval for accomplishing this task. The state health officials, in response, nominated a state government agency, Construction and Design Services (C&DS), to implement this project.

In parallel, the hospital authorities put a request to Uttar Pradesh Power Corporation Limited (UPPCL) for increasing the electricity load capacity for the hospital and for purchase of a new diesel generator to ensure power backup for the two PSA plants.

In the meantime, PATH had procured the 750-LPM PSA plant. Although the PSA plant's components arrived at the hospital in August 2021, it could not be installed and commissioned as the work on extension of MGPS, construction of new manifold system, electrical load enhancement, and the purchase of new diesel generator set had not been initiated. These activities were essential preparatory steps for equipping the site for PSA plant installation.

When PATH's team in the state discussed the issue with the Facility Nodal Officer, they were informed that there was a two-fold problem in initiating the civil work. Firstly, they had not hired a civil engineering consultant to oversee the construction of the plant site and the new manifold system. Secondly, the hospital authorities, on following up with the state's Department of Health and Family Welfare, were informed that the proposal submitted by C&DS, was still being considered for approval from the Secretariat, Government of Uttar Pradesh.

Getting the manifold room constructed

In order to expedite the construction of the PSA plant room, PATH worked with the hospital officials to hire a civil engineer as a consultant. To avoid further delays, which would result in additional cost to the facility, the hospital officials sole sourced the consultant. However, the consultant civil engineer required regular technical support from PATH for design and construction input. PATH expanded its support to RSM hospital by frequently visiting the site and continuously following up with the consultant civil engineer and the contractor to expedite the completion of the civil work of the plant room.

When the solution is right near one's hand

As the delay in approving C&DS to initiate construction work in RSM Hospital continued, the hospital officials and PATH started exploring other options. During a consultation with the Chief Development Officer (CDO) - an administrative post in some Indian states like Uttar Pradesh to oversee various developmental schemes, including infrastructure - it emerged that the state government had released a government order

recommending that the State Disaster Response Fund (SDRF) shall be utilized for the PSA plant installation. As a consequence, the budget for this activity, and by virtue of it, its approval, was provided by the District Magistrate (DM) and CDO, who jointly administer the SDRF. Due to lack of visibility among the hospital authorities on whether budget for this activity would come from the SDRF or District Health Society fund, their request was sent to the state's Department of Health and Family Welfare for sanctioning.

As the proposal from C&DS was already at the State Secretariat from the Department of Health and Family Welfare, the CDO was constrained from approving the activity under SDRF as it risked double budgeting.

PATH began leveraging the oxygen review meetings held in the district under the chairmanship of District Magistrate and CDO to bring to attention the need for budget allocation for strengthening oxygen infrastructure in RSM Hospital. PATH was one of the invitees at these meetings as the Technical Support Unit for oxygen in the state. The DM and CDO discussed this issue with Director General Medical and Health (DGMH) and other senior officials in the state government to find a solution. PATH followed up frequently, within the system, from secretariat office to DGMH office to DM office to expedite the process.

This matter remained in abeyance. However, in September 2021, a new DGHS, Dr. Ved Brat Singh, assumed office. PATH renewed its outreach to the new DGHS, who responded with matching interest. PATH team once again raised the issue in front of newly appointed DG. Dr. Singh instructed the State Nodal Officer (SNO) for Oxygen to follow this issue up on priority with the Department of Health and Family Welfare. In a few days, the SNO informed the DGHS and PATH that the budget proposal submitted by C&DS was higher than the market value and the Department of Health and Family Welfare has asked them to submit the revised proposal and budget.

"Change in leadership and change in the situation acted as catalysts for installation of plant at the facility."

Indraseni Gupta
Public Health Coordinator, PATH

By the time the CDO, hospital authorities, and PATH received clarity that the activity could be sanctioned under SDRF, the fund had already been exhausted for other infrastructure and emergency response activities in the district.

...in the end, all it needed was a spark!

Around the end of July 2021, the Government of India wrote to all state governments to expedite the installation of all PSA plants supported by PM CARES, giving them August 15, 2021, India's Independence Day, as the embargo date for a virtual inauguration of PM CARES supported PSA plants by the Hon'ble Prime Minister of India, Shri Narendra Modi. This directive from the Government of India and an uninstalled 1000 LPM PSA

plant from PM CARES in RSM Hospital played a catalytic role in bringing the attention back to the oxygen infrastructure needs of RSM Hospital.

PATH once again reached out to the CDO seeking his office's support for strengthening the oxygen infrastructure in RSM Hospital. While the Additional Chief Secretary, Department of Health and Family Welfare reviewed the proposal from C&DS and approved the budget for oxygen infrastructure development, the CDO held a meeting with the hospital officials to explore a quick solution for getting the two PSA plants installed and commissioned. During the meeting with the DHS, the DM, on input of CDO, instructed the district health officials to connect the two plants in RSM Hospital with the existing manifold. The DM released a budget of around INR 350,000 from the Rogi Kalyan Samiti fund to bridge the distance between the existing manifold and the two PSA plants.

“Regular follow-up with responsible officials to find immediate solutions rather than waiting for a permanent solution in crisis situations helped us respond to the issue.”

Anil Mishra
Oxygen State Lead - UP, PATH

With the funds released, the consultant civil engineer and the contractor completed the task with technical support from PATH. After this, the plants were connected to the existing manifold and were successfully commissioned.

“It is not every day that we install a large equipment in a hospital of our size. Two large PSA plants around the same time is unheard of! But these are extraordinary times! In the beginning, we did not know who had the funds for PSA site development. We sent our request for financial support to the state level health officials. It was only later that we got to know that the funds could be released locally from the SDRF funds on the District Magistrate's order. As our request moved between the state and the district for



Image 1. Inauguration of the 750-LPM PSA plant at Ram Sagar Mishra (RSM) Hospital by Dr (Major) G S Bajpayee, Additional Director, Health and Family Welfare, Lucknow Division, Uttar Pradesh

months, a number of challenges emerged like availability of resources, fund utilization, but we were determined to get the work done amid all the challenges. After several follow-ups and round table discussions, we found a solution to get both the plants connected to the existing MGPS. This is a stop gap arrangement till more funds are released for us to install MGPS for all our beds. Despite the delays, we now have functional PSA plants connected with MGPS in our facility.”

Anup Srivastava
Additional Chief Medical Officer
CMO Office, Lucknow

Even after the commissioning of the two PSA plants, a few minor administrative hurdles prevented them from being fully integrated into the state's health system. Finally, in December 2021, Dr (Major) G S Bajpayee, Additional Director, Health & Family Welfare, Lucknow Division, Uttar Pradesh inaugurated the PSA plants and institutionalized them.

Lessons Learnt

- Clear and transparent communication between the state and district, and between departments is essential for effective response.
- Commitment from the leadership, not just at the national level, but across state and district level, is critical for expediting response.
- Comprehensive planning, with complete awareness of oxygen demand at each facility, helps in deciding the number and capacity of the PSA oxygen plant(s) and other oxygen systems in each facility.
- It is important to prepare the site for oxygen plant installation as well as oxygen infrastructure while working on the logistics of oxygen systems. This includes hiring the right human resources, fund flow, in addition to other resources.



