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Solar Powered Radiotherapy in Africa

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Title: Solar-powered Radiotherapy 4.0 –chance for Radio-Oncology in Africa

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Introduction:

WHO estimate that 14 million people around the world are diagnosed with cancer each year and half of them live in developing countries. Around 70% of the people who die from cancer live now in low-income or medium-income countries. Cancer kills more people than HIV/AIDS, tuberculosis and malaria together. All these people share only 3% of the world's health care professionals and 1% of the world's total costs for health care. 50-60% of cancer patients require radiotherapy as important (and cost effective) part of their treatment. There is an estimated shortage of around 5.000 radiotherapy machines in low-middle-income-countries (LMICS). The majority of people in Africa suffering from cancer has no or limited access to radiotherapy technology. State of the art radiotherapy machines (linear-accelerators) need (uninterruptable) electrical power.

Project-plan, Implementation in Singen (Germany):

The Lake Constance Radiation Oncology Center, Singen run 2 Linacs of ELEKTA and 1 go.SIM-CT-Scanner of SIEMENS. The power consumption is about 150-170 MWh/a. The annual cost was about 35.000€ (dropped to 24.000€). Investigation on kW-peak-behavior of the ELEKTA-Linacs, CT, IT and cooling and a site-dependence computer-simulation on solarization was done to determine the solar-field. A cost-plan (return of investment) was developed. Each year the solar-harvest is about 55-60 MWh (based on 400m²-solar-field on the roof). It can be shown, that the annual cost can be cut by 30-40%; in summer the site is completely independent from public-grid. In case of low-sun periods electrical-power is purchased from public grid. In sunny periods the solar-generator feeds back energy in the neighborhood-hospital!

Project-cost-plan, Implementation in Ghana:

2016 the OIER (Organization for International Economic Relations, Vienna) and ELEKTA asked for a consultancy of planning a solar-power solution of the "Sweden Ghana Medical Centre". This site runs one ELEKTA-Linac, CT and MR. The annual consumption is about 270 MWh. Energy-cost from the grid is about 100.000€ in this region. A computerized simulation on solarization for this site was done. An installation schema was developed. An autarkic energy solution (solar panels + battery container) was preferred. Total cost of implementation was about 300.000€ (2017). Due to the unknown roof-shielding and the expected damage of the panels by radiation the concept of roof-mounting was converted into an area-mounting beside the main buildings minimizing cabling.

Perspective on Education, Training, Controlling:

It makes sense to expand treatment-capacity of existing sites. Increasing staff-number and staff-experiences is obligatory. Electrical power stability and autarkic, technical solutions must be included in purchasing-plans of radiotherapy-machines. Communication (Internet, Mobile, video-conferencing) need power as well. Help for low-experienced staff-group can be obtained from using automatic-planning of patients-therapy, checking and controlling with digital-assistance systems (online-dosimetry, portal-dosimetry, process-control and risk-control). All of those systems can be audited and supported via internet) as to be shown in our departments (Project: RADIOTHERAPY 4.0). Cyber-education on site by experienced remote-trainers can be ordered.

Abstract Category

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