Energy spectra of linear accelerator x-ray therapy beams are needed in various convolution-based dose computation models, widely used for conformal 3D treatment planning calculations. It is of interest to these and other models that a method be developed for obtaining therapy beam x-ray spectra. A method is proposed, based on a database of calculated tissue phantom ratios (TPR) for monoenergetic x-ray beams, and central axis depth dose measurement for the largest field size. The TPRs are obtained by an EGS4-based Monte Carlo calculation using a simplified geometrical model. The calculated TPRs for monoenergetic photons, extending to 20 MeV were linearly combined to fit the TPRs inferred from measured percent depth dose of 4 MV, 6 MV and 20 MV x-ray beams. The fluence and energy spectra can be obtained from the coefficients of the linear combination. Except for some differences in the buildup region, due mainly to electron contamination in the beam from the head, the fit is quite close. For depths 2 cm - 34 cm (4 MV, 6 MV) and 3.5 cm-34 cm (20 MV), the mean ratios of measured to calculated TPR were 1.002 ± 0.007, 1.002 ± 0.007, and 1.003 ± 0.006 for 4 MV, 6 MV and 20 MV, respectively. In 63 comparisons, measurement and calculation differed by more than 1% five times, with a maximum deviation of 1.5%. The resulting energy fluence spectra show triangular or dome shapes as a function of energy, with a peak at about 35% of the maximum energy.