O’ZBEKISTON RESPUBLIKASI
QISHLOQ VA SUV XO’JALIGI VAZIRLIGI

TOSHKENT IRRIGATSIYA VA MELIORATSIYA INSTITUTI

Kafedra: **GTEET va EJF.**

Fan: **Suv xo’jaligini elektr ta’minoti**

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KIRISH.

O‘zbekiston elektroenergetikasining rivojlanishi Boz-su elektr stansiyasini qurilishidan boshlangan. Boz-su gidroelektrstansiyasi (GES) 1921 yil 20 mayda ishga tushirilgan. Shundan keyin Chirchiq-Boz-su trakti bo‘ylab 7 ta gidrostansiyalar va 4 ta issiqlik elektr stansiyalar qurilib ishga tushirildi. Shu bilan birgalikda O‘zbekiston viloyatlarini ko‘pchilik tumanlarida kichik quvvatli xo‘jalik va o‘rta quvvatli xo‘jaliklararo gidrostansiyalar kurildi. 1950 yillarda boshlab O‘zbekistonda energetika qurilishlari katta jadal bilan rivojlanib bordi va 10 dan ortiq gidrostansiyalar qurilib ishga topshirildi. SHu jumladan Chorvoq GES (600 MVt), Xodjikent GES (165 MVt), bundan tashqari bir qancha o‘rta va kichik quvvatli gidrostansiyalar ham qurildi..

Shular qatorida O‘zbekiston energotizimi negizini, asosan issiqlik elektrostansiyalar (IES) tashkil etadi; Sirdaryo IES (quvvati 3000 MVt); Toshkent IES i (1860 MVt); YAngi-Angren IES (2100 MVt); Navoi IES (1250 MVt); Taxia-Tosh IES (1200 MVt). Ularda 30 dan ortiq yangi zamonaviy energobloklar o‘rnatilgan. Ularni har birini quvvatlari 15 dan 300 ming kVt ni tashkil qiladi.

O‘zbekiston energotizimidagi eng yirik issiqlik elektr stansiyasi Tallimarjon IES bo‘lib, uning loyiha quvvati 3200 MVt ni tashkil qiladi, har-bir energoblokining quvvati 800 ming kVt dan iborat.

O‘zbekiston energetikasiga qarashli gidro va issiqlik energostansiyalar 1991 yil 5283 MVt soat elektroenergiya ishlab chiqdi. Shundan issiqlik stansiyalar 4807 MVt soat (90,9%), gidroelektr stansiyalar esa 482 MVt soat (91%) Ishlab chiqilgan elektr energiyasini iste’molichlarga etkazib berish maqsadida O‘zbekenergo Davlat aksionerlik kompaniyasi qarmog‘ida 12 ta viloyat elektr tarmoqlar korxonalari ishlab turibdi.

Xozirgi paytda respublikada 220 ming kilometr elektr tarmoq tizimlari qurilgan. Shu jumladan kuchlanish 500 kV havo liniyalari 1600 kilometr va 220 kV kuchlanishli havo liniyalar 4600 kilometr.

O‘rnatilgan tarmoq transformatorlarning umumiy quvvati 38600 MVA dan ortiq. Shu jumladan 35 kV va undan yuqori kuchlanish tarmoqlardagi transformatorlar 2420 ta, 500 kV li transformatorlarning quvvati 3507 MVA.

O‘zbekiston energotizimi respublika iste’molchilarini elektr energiyasiga bo‘lgan talabalarini to‘liq qondira oladi, bundan tashqari ishlab chiqarilayotgan elektr energiyasining bir qismini Janubiy Qozog‘iston, Tojikiston, Qirg‘izston va Afg‘onistonga eksport qilinadi.

1956 yillarda Respublikani ko‘pchilik viloyatlarida quruq va bo‘z erlarni o‘zlashtirishi bilan yirik nasos stansiyalarni qurilishi, 1980 yillarda xo‘jaliklarda yirik komplekslarni qurilishi va ularni mahsulotlarini qayta ishlab chiqarish korxonalarini qurilishlari tufayli 7200 dan ortiq elektr yuritmalar ishga tushirildi, ularni iste’mol qiladigan quvvati 37176 MVt soatni tashkil etadi. Ko‘p xo‘jaliklarda suvdan foydalinsh uchun 252 ta nasos stansiyalari o‘ranatilgan.

O‘zbekiston iqtisodiy konsepsiyasiga ko‘ra 1990 yilga nisbatan 2010 yilgacha ishlab chiqarishning ijtimoiy mahsuloti 1,7 marta va milliy daromadi 1,6 marta oshishi ko‘zda tutilgan. SHu konsepsiya asosida elektr energiyasini xalq xo‘jaligidagi talabi 1995 yilga 60 mlrd. kVt soat, 2000 yilda 70 mlrd kVt. soat, 2005 yilda soat, 88 mlrd kVt soat va 2010 yilga 96 mlrd. kVt soat etkazish nazarda tutilgan. SHu jumladan bu ko‘rsatkich, ishlab chiqarish korxonalarida 1990-2010 yillarda 13,55-14,37 mlrd kVt soatga oshadi (ya’ni 1,5-1,6 marta), qishloq va suv xo‘jaligida esa 8,4-8,5 mlrd kVt soatga oshadi (ya’ni 1,7-1,8 marta) degani.

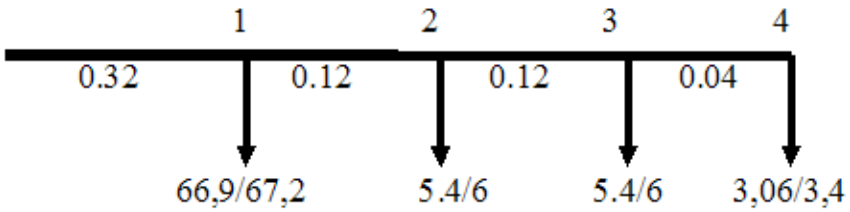
2010 yilda bo‘ladigan elektr energiyasiga bo‘lgan talablarni qoniqtirish maqsadida yangi gidro va issiqlik elektrstansiyalarni qurish va ishlab turgan issiqlik stansiyalariga qo‘shimcha energobloklar o‘rnatiladi**.**

1. Kuchlanishli 0,4 kV elektr tarmoqning yuklamasini hisoblash

Transformator podstansiyasidan uzatiluvchi 1–liniya (L1)dagi yuklamalarni hisoblaymiz.
L-1 dagi iste'molchilar aholi turar joylaridan tashkil topgan. Hisoblash uchun 1-liniyani ko'cha bo'ylab chizib chiqamiz va sim ustunlarni o'rnatib chiqamiz. Bunda shimol tomon, shamolning yo'nalishi, va masshtabni aniq bilish talab etiladi. Ularni chizmiaga quyib chiqamiz (1-rasm)

Liniya bo'ylab tok bo'linish nuqtalarini belgilab chiqamiz va bir chizziqli hisob sxemasini chizamiz. Unga: tok bo'linish nuqtalari orasidagi masofani, kunduzgi va tungi yuklamalarni yozib chiqamiz. (2-rasm)

TP 1 L1



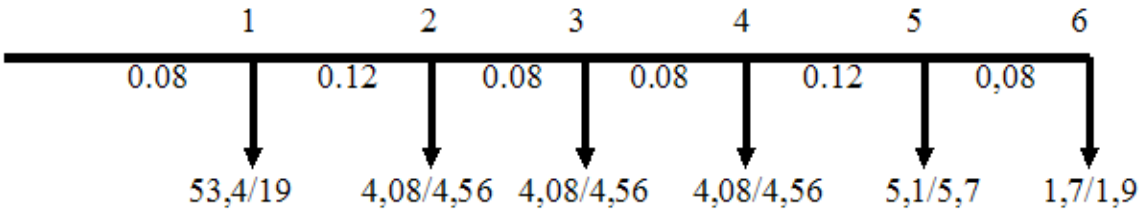
2-rasm. Bir chizziqli elektr hisob sxemasi

2-rasm asosida L1 dagi yuklamalarni hisoblaymiz:

$P_{kunL1} = P_{1kun} + P_{2kun} + P_{3kun} + P_{4kun} + P_{5kun} = (1,8+1,8) \cdot 0,85+(1,8+1,8+1,8+1,8) \cdot$
$\cdot 0,75+(1,8+1,8+1,8+1,8) \cdot 0,75+(1,8+1,8+80) \cdot 0,75=80,76$ kVt

$P_{tunL1} = P_{1tun} + P_{2tun} + P_{3tun} + P_{4tun} + P_{5tun} =$
$(2+2)\cdot 0.85+(2+2+2+2)\cdot 0.75+(2+2+2+2)\cdot 0.75+(2+2+70)\cdot 0.75=82,6$ kVt

TP1 L2



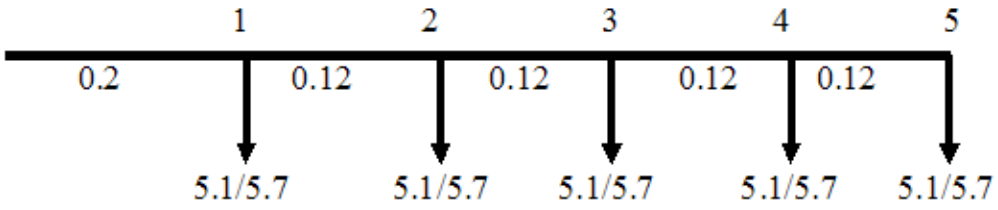
3-rasm. Bir chizziqli elektr hisob sxemasi

3-rasm asosida L2 dagi yuklamalarni hisoblaymiz. L2 ning bir chiziqli elektr xisob sxemasini tuzamiz va yuklamani hisoblaymiz.

$P_{kunL2} = P_{1kun} + P_{2kun} + P_{3kun} + P_{4kun} + P_{5kun}$
$=1,7+(1.7+1.7+1.7+1.7)\cdot 0.75+(1.7+1.7+1.7)\cdot 0.75+(1.7+1.7+1.7)\cdot 0.75+(1.7+1,7+1.7)\cdot 0.75+$
$+(1.7+1.7+40)=53.44$ kVt

$P_{tunL2} = P_{1tun} + P_{2tun} + P_{3tun} + P_{4tun} + P_{5tun}$
$=1.9+(1.9+1.9+1.9+1.9)\cdot 0.75+(1.9+1.9+1.9)\cdot 0.75+(1.9+1.9+1.9)\cdot 0.75+(1.9+1.9+1.9)\cdot 0.75+$
$+(1.9+1.9+20)\cdot 0.75=39.98$ kVt

TP1 L3



4-rasm. Bir chizziqli elektr hisob sxemasi

4-rasm asosida L3 dagi yuklamani hisoblaymiz

$P_{kunL3} = P_{1kun} + P_{2kun}$=(1.7+1.7+1.7+1.7)·0.75+(1.7+1.7+1.7+1.7)·0.75+(1.7+1.7+1.7+1.7)·0.75+ +(1.7+1.7+1.7+1.7)·0.75+(1.7+1.7+1.7+1.7)·0.75=25.5 kVt

$P_{tunL3} = P_{1tun} + P_{2tun}$=(1.9+1.9+1.9+1.9)·0.75+(1.9+1.9+1.9+1.9)·0.75+(1.9+1.9+1.9+1.9)·0.75+ +(1.9+1.9+1.9+1.9)·0.75+(1.9+1.9+1.9+1.9)·0.75=28.5 kVt

Transformator podstansiyasining quvvatini aniqlash uchun liniyalar bo‘yicha umumiy yuklamani topamiz.

$$P_{TPkun} = P_{kunL1} + P_{kunL2} + P_{kunL3} = 80.76+53.44+25.5=159.7 \text{ kVt}$$

$$P_{TPtun} = P_{tunL1} + P_{tunL2} + P_{tunL3} = 82.6+39.98+28.5 = 151 \text{ kVt}$$

Transformatorning quvvati to‘la quvvatda bo‘lganligi uchun elektr iste’molchilarning aktiv quvvatdagi umumiy yuklamasini to‘la quvvatga aylantiramiz. Buning uchun quyimdagi formula o‘rinlidir:

$$S = \frac{P}{\cos\varphi}, кВА$$

Aktiv kuvvat koeffitsienti – ***cosφ*** ni topish uchun P_{kun}/P_{tun} ko‘rsatkichini topish so‘raladi.

$$P_{kun} / P_{tun} = 159.7/151=1.06$$

ko‘rsatkichi uchun ilovadagi 4 – jadvaldan ***cosφ*** qiymatini topamiz:

$$cos\varphi_{kun}= 0,8 \quad cos\varphi_{tun}= 0,89$$

U holda: $S_{кун} = \frac{P_{кун}}{\cos\varphi_{кун}} = \frac{159,7}{0,8} = 199,6 кВА$

$$S_{тун} = \frac{P_{тун}}{\cos\varphi_{тун}} = \frac{151}{0,89} = 169,6 кВА$$

Ob’ektimiz uchun standart quvvatli TM250 moy transformatorini tanlaymiz.

2. Kuchlanishi 0,4 kV li havo liniya (HL)sini kesimini hisoblaymiz:

a) L-1 ning kesimini topamiz. Buning uchun quyidagi formula asqotadi: $P = \sqrt{3} \cdot I \cdot U \cdot \cos\varphi$

Ushbu formuladan tokni topamiz:

$$I_{кун} = \frac{P_{кун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{кун}} = \frac{80,76}{1,73 \cdot 0,4 \cdot 0,8} = 146A$$

$$I_{тун} = \frac{P_{тун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{тун}} = \frac{82,6}{1,73 \cdot 0,4 \cdot 0,89} = 134A$$

$$F_{икт.кунЛ1} = \frac{I_{кунЛ1}}{j_{икт}} = \frac{146}{1,3} = 112,3мм^2$$

$$F_{икт.тунЛ1} = \frac{I_{тун}}{j_{икт}} = \frac{134}{1,3} = 103мм^2$$

Ilovadagi 6-jadvaldan 146 A uchun A25 alyumin simini tanlaymiz.

b) L-2 ning kesimini topamiz:

$$I_{кун} = \frac{P_{кун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{кун}} = \frac{53.44}{1,73 \cdot 0,4 \cdot 0,8} = 96.5A$$

$$I_{тун} = \frac{P_{тун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{тун}} = \frac{39.98}{1,73 \cdot 0,4 \cdot 0,89} = 64.5A$$

$$F_{икт.кунЛ2} = \frac{I_{кунЛ1}}{j_{икт}} = \frac{96.5}{1,3} = 74.2мм^2$$

$$F_{икт.тунЛ2} = \frac{I_{тун}}{j_{икт}} = \frac{64.5}{1,3} = 49.6мм^2$$

Ilovadagi 6-jadvaldan 96.5 A uchun A16 alyumin simini tanlaymiz.

v) L-3 ning kesimini topamiz:

$$I_{кун} = \frac{P_{кун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{кун}} = \frac{25.5}{1,73 \cdot 0,4 \cdot 0,8} = 46.06A$$

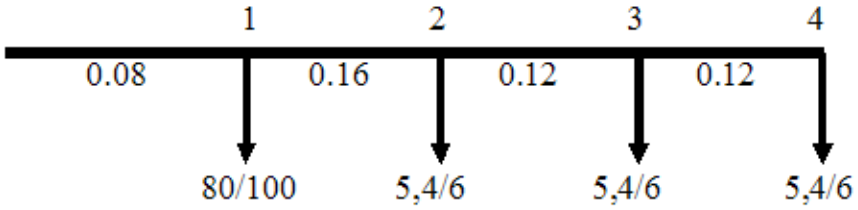
$$I_{тун} = \frac{P_{тун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{тун}} = \frac{28.5}{1,73 \cdot 0,4 \cdot 0,89} = 46.27A$$

$$F_{икт.кунЛ3} = \frac{I_{кунЛ1}}{j_{икт}} = \frac{46.06}{1,3} = 35.4.мм^2$$

$$F_{икт.тунЛ3} = \frac{I_{тун}}{j_{икт}} = \frac{46.27}{1,3} = 35.6мм^2$$

Ilovadagi 6-jadvaldan 46 A uchun A16 alyumin simini tanlaymiz.

TP 2 L1



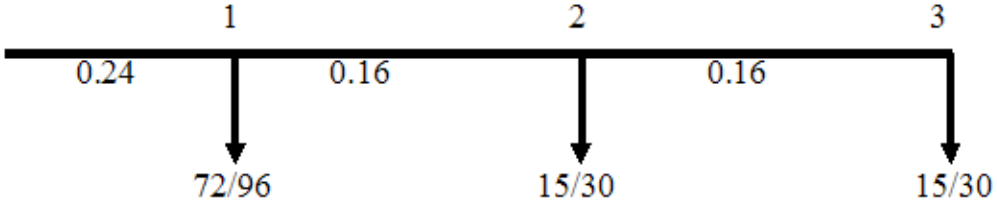
5-rasm. Bir chizziqli elektr hisob sxemasi

5-rasm asosida L1 dagi yuklamalarni hisoblaymiz:

$P_{kunL1} = P_{1kun} + P_{2kun} + P_{3kun} + P_{4kun} + P_{5kun} =$ (5+5+5+5)·0.75+(5+5+5+5)·0.75+(5+5+5+5)·0.75+ +80=96,2 kVt

$P_{tunL1} = P_{1tun} + P_{2tun} + P_{3tun} + P_{4tun} + P_{5tun}$ = (10+10+10+10)·0.75+(10+10+10+10)·0.75+ (10+10+10+10)·0.75+100= 118 kVt

TP2 L2



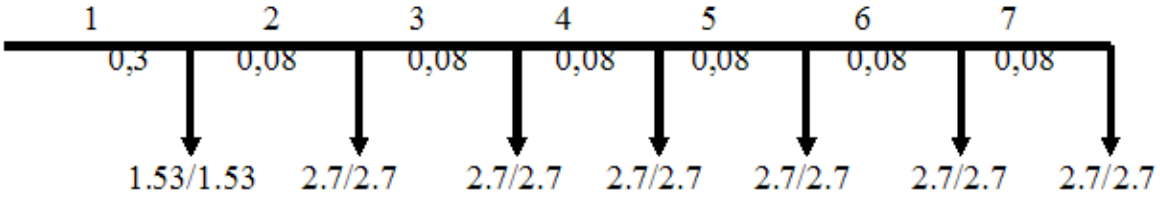
6-rasm. Bir chizziqli elektr hisob sxemasi

6-rasm asosida L2 dagi yuklamalarni hisoblaymiz. L2 ning bir chiziqli elektr xisob sxemasini tuzamiz va yuklamani hisoblaymiz.

$P_{kunL2} = P_{1kun} + P_{2kun} + P_{3kun}$ =(5+5+5+5)·0.75+(5+5+5+5)·0.75+(5+5)·0.85=102 kVt

$P_{tunL2} = P_{1tun} + P_{2tun} + P_{3tun}$ =(10+10+10+10)·0.75+ (10+10+10+10)·0.75+(10+10)·0.85=156 kVt

TP2 L3



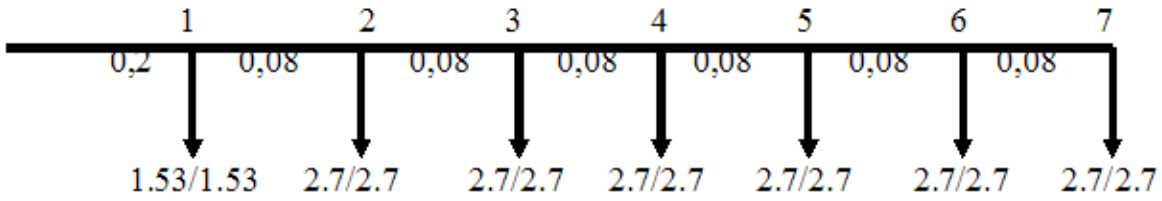
7-rasm. Bir chiziqli elektr hisob sxemasi

7-rasm asosida L3 dagi yuklamani hisoblaymiz

$P_{kunL3} = P_{1kun} + P_{2kun} + P_{3kun} + P_{4kun} + P_{5kun} + P_{6kun} + P_{7kun}$=(0.9+0.9+0.9+0.9) · 0.75+(0.9+0.9+0.9+0.9) · 0.75 + (0.9+0.9+0.9+0.9) · 0.75+(0.9+0.9+0.9+0.9) · 0.75+(0.9+0.9+0.9+0.9) · 0.75+(0.9+0.9+0.9+0.9)·0.75+(0.9+0.9)·0.85= =17.7 kVt

$P_{tunL3} = P_{1tun} + P_{2tun} + P_{3tun} + P_{4tun} + P_{5tun} + P_{6tun} + P_{7tun} = (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9) \cdot 0.85 = 17.7$ kVt

TP2 L4



7-rasm. Bir chiziqli elektr hisob sxemasi

7-rasm asosida L3 dagi yuklamani hisoblaymiz

$P_{kunL3} = P_{1kun} + P_{2kun} + P_{3kun} + P_{4kun} + P_{5kun} + P_{6kun} + P_{7kun} = (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9) \cdot 0.85 = 17.7$ kVt

$P_{tunL3} = P_{1tun} + P_{2tun} + P_{3tun} + P_{4tun} + P_{5tun} + P_{6tun} + P_{7tun} = (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9+0.9+0.9) \cdot 0.75 + (0.9+0.9) \cdot 0.85 = 17.7$ kVt

Transformator podstansiyasining quvvatini aniqlash uchun liniyalar bo‘yicha umumiy yuklamani topamiz.

$$P_{TPkun} = P_{kunL1} + P_{kunL2} + P_{kunL3} + P_{kunL4} = 96,2+102+17,7+17,7 = 233,6 \text{ kVt}$$

$$P_{TPtun} = P_{tunL1} + P_{tunL2} + P_{tunL3} + P_{tunL4} = 118+156+17,7+17,7 = 309,4 \text{ kVt}$$

Transformatorning quvvati to‘la quvvatda bo‘lganligi uchun elektr iste’molchilarning aktiv quvvatdagi umumiy yuklamasini to‘la quvvatga aylantiramiz. Buning uchun quyimdagi formula o‘rinlidir:

$$S = \frac{P}{\cos\varphi}, кВА$$

Aktiv kuvvat koeffitsienti – ***cosφ*** ni topish uchun P_{kun}/P_{tun} ko‘rsatkichini topish so‘raladi.

$$P_{kun} / P_{tun} = 233,6/309,4 = 0,75$$

ko‘rsatkichi uchun ilovadagi 4 – jadvaldan ***sosφ*** qiymatini topamiz:

$$\boldsymbol{cos\varphi}_{kun} = 0,85 \qquad \boldsymbol{cos\varphi}_{tun} = 0,93$$

U holda: $S_{кун} = \frac{P_{кун}}{\cos\varphi_{кун}} = \frac{233,6}{0,85} = 274,8 кВА$

$$S_{тун} = \frac{P_{тун}}{\cos\varphi_{тун}} = \frac{309,4}{0,93} = 332,7 кВА$$

Ob’ektimiz uchun standart quvvatli TM400 moy transformatorini tanlaymiz.

Kuchlanishi 0,4 kV li havo liniya (HL)sini kesimini hisoblaymiz:

a) L-1 ning kesimini topamiz. Buning uchun quyidagi formula asqotadi: $P = \sqrt{3} \cdot I \cdot U \cdot \cos\varphi$

Ushbu formuladan tokni topamiz:

$$I_{кун} = \frac{P_{кун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{кун}} = \frac{96{,}2}{1{,}73 \cdot 0{,}4 \cdot 0{,}85} = 163{,}55A$$

$$I_{тун} = \frac{P_{тун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{тун}} = \frac{118}{1{,}73 \cdot 0{,}4 \cdot 0{,}93} = 183.35A$$

$$F_{икт.кунЛ1} = \frac{I_{кунЛ1}}{j_{икт}} = \frac{163.55}{1{,}3} = 125.8мм^2$$

$$F_{икт.тунЛ1} = \frac{I_{тун}}{j_{икт}} = \frac{183.35}{1{,}3} = 141мм^2$$

Ilovadagi 6-jadvaldan 184 A uchun A35 alyumin simini tanlaymiz.

b) L-2 ning kesimini topamiz:

$$I_{кун} = \frac{P_{кун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{кун}} = \frac{102}{1{,}73 \cdot 0{,}4 \cdot 0{,}85} = 173{,}4A$$

$$I_{тун} = \frac{P_{тун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{тун}} = \frac{156}{1{,}73 \cdot 0{,}4 \cdot 0{,}93} = 242{,}4A$$

$$F_{икт.кунЛ2} = \frac{I_{кунЛ1}}{j_{икт}} = \frac{173{,}4}{1{,}3} = 133{,}4мм^2$$

$$F_{икт.тунЛ2} = \frac{I_{тун}}{j_{икт}} = \frac{242{,}4}{1{,}3} = 186{,}46мм^2$$

Ilovadagi 6-jadvaldan 242 A uchun A50 alyumin simini tanlaymiz.

v) L-3 ning kesimini topamiz:

$$I_{кун} = \frac{P_{кун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{кун}} = \frac{17.7}{1{,}73 \cdot 0{,}4 \cdot 0{,}85} = 30.1A$$

$$I_{тун} = \frac{P_{тун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{тун}} = \frac{17.7}{1{,}73 \cdot 0{,}4 \cdot 0{,}93} = 27.5A$$

$$F_{икт.кунЛ3} = \frac{I_{кунЛ3}}{j_{икт}} = \frac{30.1}{1{,}3} = 23.15мм^2$$

$$F_{икт.тунЛ3} = \frac{I_{тун}}{j_{икт}} = \frac{27.5}{1{,}3} = 21.15мм^2$$

Ilovadagi 6-jadvaldan 30 A uchun A70 alyumin simini tanlaymiz.

g) L-3 ning kesimini topamiz:

$$I_{кун} = \frac{P_{кун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{кун}} = \frac{17.7}{1{,}73 \cdot 0{,}4 \cdot 0{,}85} = 30.1A$$

$$I_{тун} = \frac{P_{тун}}{\sqrt{3} \cdot U \cdot \cos\varphi_{тун}} = \frac{17.7}{1{,}73 \cdot 0{,}4 \cdot 0{,}93} = 27.5A$$

$$F_{икт.кунЛ3} = \frac{I_{кунЛ3}}{j_{икт}} = \frac{30.1}{1{,}3} = 23.15мм^2$$

$$F_{икт.тунЛ3} = \frac{I_{тун}}{j_{икт}} = \frac{27.5}{1{,}3} = 21.15мм^2$$

Ilovadagi 6-jadvaldan 30 A uchun A16 alyumin simini tanlaymiz.

3. ELEKTR TARMOG‘IDAGI YUKLAMANI REAKTIV QUVVAT BO‘YICHA HISOBLASH

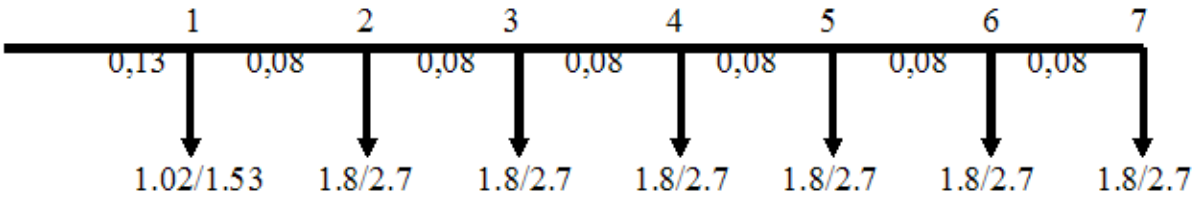
2009 yil O‘ZBEKENERGO DAK ning qaroriga asosan barcha elektr tarmoqlarida elektr energiyasini tejash va sarf miqdorini kamaytirish maqsadida aktiv quvvat bilan birga reaktiv quvvat uchun ham haq to‘lash tizimi joriy etildi. SHu sababali aktiv quvat koeffitsientining ko‘rsatkichlari past bo‘lgan tarmoqlarda reaktiv quvvatni kompensatsiyalan uchun kompensatsiyalovchi qurilmalarni o‘rnatish maqsad qilib qo‘yildi. Reaktiv quvatni kompensatsiyalash uchun uni hisoblash usulini o‘rganish talab etiladi.

Buning uchun quyidagim ma’lumotlar kerak bo‘ladi:

Kuchlanishi 0,4 kV tarmog‘idagi ruxsat etilgan kuchlanish isrofi $\Delta U_{r.e.}$ = 8,5%, havo liniyasining simlari orasidagi o‘rta geometrik masofa ***$D_{o‘rt}$=1000mm***.

Elektr iste’molchilarning yuklamasi aktiv quvatda berilganligi bois uning aktiv quvvat koeffitsientini miqdorini topish shart. Buning uchun kunduzgi yuklamiani tungi yuklamaga bo‘lish orqali aktiv quvvat koeffitsientiga mos keluvchi kiymatni aniqlanadi. Buning uchun har bir transformator podstansiyasidan uzatiluvchi kuchlanishi 0,4 kV li liniyalardagi aktiv quvvat koeffitsientini topish kifoya. Masalaga yechim topish uchun 1 – masaladagi ma’lumotlar va echimlardan foydalanish mumkin.

TP3 L1



8-rasm. Bir chizziqli elektr hisob sxemasi

1-liniyadagi 1- tok taqsimlanish nuqtasidagi yuklamaga ko‘ra:

$$\frac{P_{кунТП1}}{P_{тунТП1}} = \frac{1{,}8}{2{,}7} = 0{,}66$$

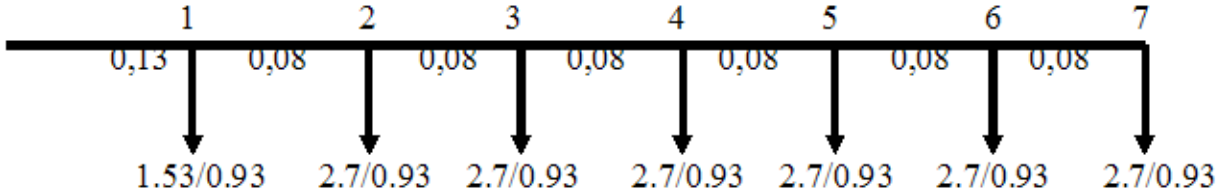
0,66 (0,61 ÷ 0,85) ko‘rsatkichi uchun ilovadagi 4 – jadvaldan ***cosφ*** qiymatini topamiz: ***cosφ***$_{kun}$= 0,85 ***cosφ***$_{tun}$= 0,93

Masalani yechishda qulay bo‘lishi uchun olingan natijalarni jadval ko‘rinishida yozish mumkin.

1 - jadval. 0,4 kV iste’molchilar uchun quvvat koeffitsientini qiymatlari

Tok bo‘linish nuqtasi	R_{kun}/R_{tun}	cosφ	
		Kun	Tun
1	0.66	0,85	0,93
2	0.66	0,85	0,93
3	0.66	0,85	0,93
4	0.66	0,85	0,93
5	0.66	0.85	0.93
6	0.66	0.85	0.93
7	0.66	0.85	0.93

YUklamalar farqiga ko‘ra 1-liniyadagi tungi yuklamalar kunduzgiga qaraganda kattaroq. SHu sababli har bir iste’molchi uchun tungi yuklama va aktiv quvvat qiymatini topgan holda elektr sxemasi yana bir marta chiziladi.



8.2 – rasm. 1-liniyaning bir chizikli elektr sxemasi.

Elektr iste’molchilarning yuklamasini reaktiv quvat ko‘rinishiga keltirish uchun quyidagi formuladan foydalanish mumkin:

$$\sin\varphi = \sqrt{1-\cos\varphi^2}$$

Har bir iste’molchi ob’ekt uchun reaktiv quvat koeffitsienti qiymatlarini topiladi.

$$\sin\varphi_1 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$
$$\sin\varphi_2 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$
$$\sin\varphi_3 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$
$$\sin\varphi_4 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$
$$\sin\varphi_5 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$
$$\sin\varphi_6 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$
$$\sin\varphi_6 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$

Tarmoqdagi reaktiv quvvatli yuklama topiladi.

Buning uchun $\frac{\sin\varphi}{\cos\varphi} = tg\varphi$ tengligi asqotadi.

$$Q_1 = P_1 \cdot tg\varphi = 2{,}7 \cdot \frac{0{,}37}{0{,}93} = 1.07\,\text{kVAr}$$
$$Q_2 = P_1 \cdot tg\varphi = 2{,}7 \cdot \frac{0{,}37}{0{,}93} = 1{,}07\,\text{kVAr}$$
$$Q_5 = P_1 \cdot tg\varphi = 2.7 \cdot \frac{0{,}37}{0{,}93} = 1{,}07\,\text{kVAr}$$
$$Q_6 = P_1 \cdot tg\varphi = 2.7 \cdot \frac{0{,}37}{0{,}93} = 1{,}07\,\text{kVAr}$$

$Q_3 = P_1 \cdot tg\varphi = 2.7 \cdot \frac{0,37}{0,93} = 1,07\,\text{kVAr}$ $Q_7 = P_1 \cdot tg\varphi = 1,53 \cdot \frac{0,37}{0,93} = 0,6\,\text{kVAr}$

$Q_4 = P_1 \cdot tg\varphi = 2.7 \cdot \frac{0,37}{0,93} = 1,07\,\text{kVAr}$

1. Istemolchilarning to‘la quvvati hisoblanadi:

$S_1 = P_1 - j\,Q_1 = 2.7 - j1.07$; $S_2 = 2.7 - j1.07$; $S_3 = 2.7 - j\,1.07$; $S_4 = 2.7 - j1.07$ $S_5 = 2.7 - j1.07$; $S_6 = 2.7 - j1.07$; $S_7 = 1.53 - j0.6$;

2. Liniyalardagi ehtimoliy quvvatlarni topamiz:

$$\dot{S}_{A-1} = \dot{S}_1 + \dot{S}_2 + \dot{S}_3 + \dot{S}_4 + \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 17.73 - j7.02;$$

$$\dot{S}_{1-2} = \dot{S}_2 + \dot{S}_3 + \dot{S}_4 + \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 15,03 - j5,95$$

$$\dot{S}_{2-3} = \dot{S}_3 + \dot{S}_4 + \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 12,33 - j4,88;$$

$$\dot{S}_{3-4} = \dot{S}_4 + \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 9,63 - j3,81$$

$$\dot{S}_{4-5} = \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 6,93 - j2,74$$

$$\dot{S}_{5-6} = \dot{S}_6 + \dot{S}_7 = 4,23 - j1.67$$

$$\dot{S}_{6-7} = \dot{S}_7 = 1.53 - j0.6$$

3. Kuchlanish isrofining absolyut qiymatini topamiz:

$$\Delta U_{p.э.} = \frac{10000 \cdot 8.5}{100} = 850B$$

Rangli metalldan yasalgan o‘tkazgichlar $D_{o‘rt.} = 1000$ **mm** bo‘lgan elektr tarmoqlarda induktiv qarshilik x_o **= 0.36 - 0.4** Om/km bo‘lganligi sababli x_o **= 0.4** Om/km qabul qilamiz.

4. Reaktiv qarshiliklar ta’sirida yo‘qotiladigan kuchlanish isrofini hisoblaymiz:
5.

$$\Delta U_p = \frac{x_0 \cdot \Sigma \cdot Q \cdot \ell}{U_н} = \frac{0,4 \cdot (0.6 \cdot 0,13 + 1,07 \bullet 0,08 + 1,07 \bullet 0,08 + 1,07 \bullet 0,08 + 1,07 \bullet 0,08 + 1,07 \bullet 0,08 + 1,07 \bullet 0,08)}{10} = 0.2B$$

6. Aktiv quvvatdan yo‘qotiluvchi kuchlanish isrofini hisoblaymiz:

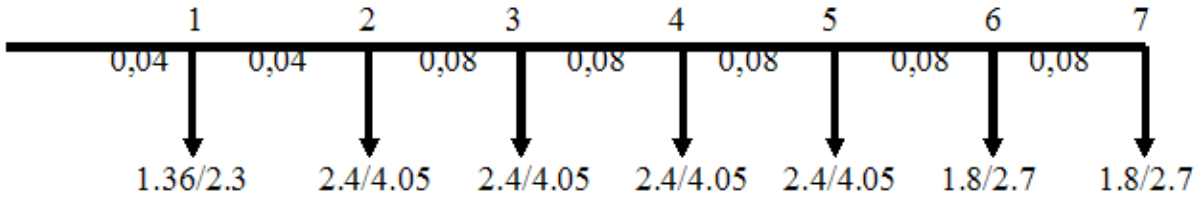
$$\Delta U_a = \Delta U_{r.e.} - \Delta U_{ish} = 850 - 0,2 = 849,8 \approx 850\ B$$

7. Elektr o‘tkazgich kesimini hisoblaymiz:

$$F = \frac{\Sigma \cdot P \cdot \ell}{\gamma \cdot \Delta Ua \cdot Uн} = \frac{1{,}53 \cdot 130 + 2{,}7 \cdot 8 + 2{,}7 \cdot 8 + 2{,}7 \cdot 8 + 2{,}7 \cdot 8 + 2{,}7 \cdot 8 + 2{,}7 \cdot 8}{32 \cdot 0{,}85 \cdot 0{,}4} = 30{,}2 мм^2$$

Hisob ma'lumotlari asosida ichki qarshiligi r_o = ***2,16 Om/km,*** x_o = ***0,36 Om/km*** bo'lgan standart kesimli alyumin-po'lat simi **A 16** ni tanlaymiz.

TP3 L2



9-rasm. Bir chizziqli elektr hisob sxemasi

1-liniyadagi 1- tok taqsimlanish nuqtasidagi yuklamaga ko'ra:

$$\frac{P_{кунТП1}}{P_{тунТП1}} = \frac{2{,}4}{4{,}05} = 0{,}61$$

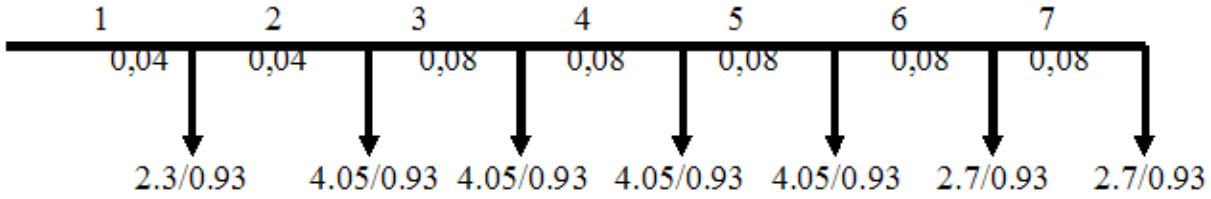
0,61 (0,61 ÷ 0,85) ko'rsatkichi uchun ilovadagi 4 – jadvaldan ***sosφ*** qiymatini topamiz: $cos\varphi_{kun}$= 0,85 $cos\varphi_{tun}$= 0,93

Masalani yechishda qulay bo'lishi uchun olingan natijalarni jadval ko'rinishida yozish mumkin.

2 - jadval. 0,4 kV iste'molchilar uchun quvvat koeffitsientini qiymatlari

Tok bo'linish nuqtasi	R_{kun}/R_{tun}	cosφ	
		Kun	Tun
1	0.61	0,85	0,93
2	0.61	0,85	0,93
3	0.61	0,85	0,93
4	0.61	0,85	0,93
5	0.61	0.85	0.93
6	0.61	0.85	0.93
7	0.61	0.85	0.93
8	0.61	0.85	0.93

YUklamalar farqiga ko'ra 1-liniyadagi tungi yuklamalar kunduzgiga qaraganda kattaroq. SHu sababli har bir iste'molchi uchun tungi yuklama va aktiv quvvat qiymatini topgan holda elektr sxemasi yana bir marta chiziladi.



9.2 – rasm. 1-liniyaning bir chizikli elektr sxemasi.

Elektr iste'molchilarning yuklamasini reaktiv quvat ko'rinishiga keltirish uchun quyidagi formuladan foydalanish mumkin:

$$\sin\varphi = \sqrt{1-\cos\varphi^2}$$

Har bir iste'molchi ob'ekt uchun reaktiv quvat koeffitsienti qiymatlarini topiladi.

$$\sin\varphi_1 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$
$$\sin\varphi_2 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$
$$\sin\varphi_3 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$
$$\sin\varphi_4 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$
$$\sin\varphi_5 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$
$$\sin\varphi_6 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$
$$\sin\varphi_6 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0{,}93^2} = \sqrt{1-0{,}86} = 0{,}37$$

Tarmoqdagi reaktiv quvvatli yuklama topiladi.

Buning uchun $\frac{\sin\varphi}{\cos\varphi} = tg\varphi$ tengligi asqotadi.

$$Q_1 = P_1 \cdot tg\varphi = 2{,}3 \cdot \frac{0{,}37}{0{,}93} = 0{,}91\,\text{kVAr}$$
$$Q_2 = P_1 \cdot tg\varphi = 4{,}05 \cdot \frac{0{,}37}{0{,}93} = 1{,}6\,\text{kVAr}$$
$$Q_3 = P_1 \cdot tg\varphi = 4{,}05 \cdot \frac{0{,}37}{0{,}93} = 1{,}6\,\text{kVAr}$$
$$Q_4 = P_1 \cdot tg\varphi = 4{,}05 \cdot \frac{0{,}37}{0{,}93} = 1{,}6\,\text{kVAr}$$
$$Q_5 = P_1 \cdot tg\varphi = 4{,}05 \cdot \frac{0{,}37}{0{,}93} = 1{,}6\,\text{kVAr}$$
$$Q_6 = P_1 \cdot tg\varphi = 2{,}7 \cdot \frac{0{,}37}{0{,}93} = 1{,}07\,\text{kVAr}$$
$$Q_7 = P_1 \cdot tg\varphi = 2{,}7 \cdot \frac{0{,}37}{0{,}93} = 1{,}07\,\text{kVAr}$$

1. Istemolchilarning to'la quvvati hisoblanadi:

$S_1 = P_1 - j\,Q_1 = 2.3 - j0.91$; $S_2 = 4.05 - j1.6$; $S_3 = 4.05 - j1.6$; $S_4 = 4.05 - j1.6$ $S_5 = 4.05 - j1.6$; $S_6 = 2.7 - j1.07$; $S_7 = 2.7 - j1.07$;

2. Liniyalardagi ehtimoliy quvvatlarni topamiz:

$$\dot{S}_{A-1} = \dot{S}_1 + \dot{S}_2 + \dot{S}_3 + \dot{S}_4 + \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 23{,}9 - j9{,}45;$$

$$\dot{S}_{1-2} = \dot{S}_2 + \dot{S}_3 + \dot{S}_4 + \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 21{,}6 - j8{,}54$$

$$\dot{S}_{2-3} = \dot{S}_3 + \dot{S}_4 + \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 17{,}55 - j6{,}94;$$

$$\dot{S}_{3-4} = \dot{S}_4 + \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 13{,}5 - j5{,}34$$

$$\dot{S}_{4-5} = \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 9{,}45 - j3{,}74$$

$$\dot{S}_{5-6} = \dot{S}_6 + \dot{S}_7 = 5{,}4 - j2{,}14$$

$$\dot{S}_{6-7} = \dot{S}_7 = 2{,}7 - j1{,}07$$

3. Kuchlanish isrofining absolyut qiymatini topamiz:

$$\Delta U_{p.э.} = \frac{10000 \cdot 8.5}{100} = 850B$$

Rangli metalldan yasalgan o‘tkazgichlar $D_{o‘rt.}$***=1000 mm*** bo‘lgan elektr tarmoqlarda induktiv qarshilik x_o **= 0.36 - 0.4** Om/km bo‘lganligi sababli x_o **= 0.4** Om/km qabul qilamiz.

4. Reaktiv qarshiliklar ta’sirida yo‘qotiladigan kuchlanish isrofini hisoblaymiz:

$$\Delta U_p = \frac{x_0 \cdot \Sigma \cdot Q \cdot \ell}{U_н} = \frac{0{,}4 \cdot (0{,}91 \cdot 0{,}04 + 1{,}6 \bullet 0{,}04 + 1{,}6 \bullet 0{,}08 + 1{,}6 \bullet 0{,}08 + 1{,}6 \bullet 0{,}08 + 1{,}07 \bullet 0{,}08 + 1{,}07 \bullet 0{,}08)}{10} = 0{,}066B$$

5. Aktiv quvvatdan yo‘qotiluvchi kuchlanish isrofini hisoblaymiz:

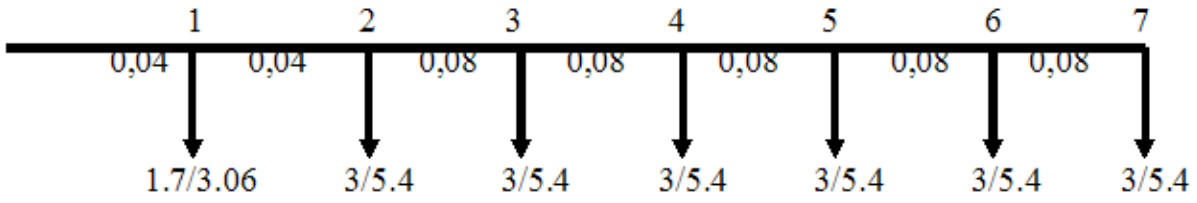
$$\Delta U_a = \Delta U_{r.e.} - \Delta U_{ish} = 850 - 0{,}066 = 849{,}9 \approx 850\ B$$

6. Elektr o‘tkazgich kesimini hisoblaymiz:

$$F = \frac{\Sigma \cdot P \cdot \ell}{\gamma \cdot \Delta Ua \cdot Uн} = \frac{2{,}3 \cdot 4 + 4{,}05 \cdot 4 + 4{,}05 \cdot 8 + 4{,}05 \cdot 8 + 4{,}05 \cdot 8 + 2{,}7 \cdot 8 + 2{,}7 \cdot 8}{32 \cdot 0{,}85 \cdot 0{,}4} = 15{,}2мм^2$$

Hisob ma’lumotlari asosida ichki qarshiligi r_o **= 2,16 Om/km,** x_o **= 0,36 Om/km** bo‘lgan standart kesimli alyumin-po‘lat simi **A 16** ni tanlaymiz.

TP3 L3



10-rasm. Bir chizziqli elektr hisob sxemasi

1-liniyadagi 1- tok taqsimlanish nuqtasidagi yuklamaga ko‘ra:

$$\frac{P_{кунТП1}}{P_{тунТП1}} = \frac{3}{5,4} = 0,55$$

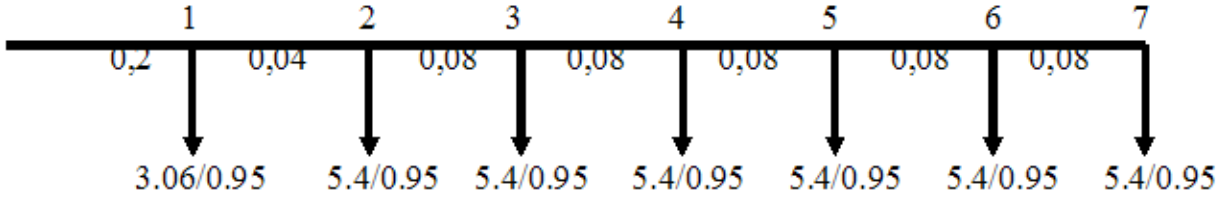
0,55 (0,36 ÷ 0,6) ko‘rsatkichi uchun ilovadagi 4 – jadvaldan ***sosφ*** qiymatini topamiz: $cos\varphi_{kun}$= 0,9 $cos\varphi_{tun}$= 0,95

Masalani yechishda qulay bo‘lishi uchun olingan natijalarni jadval ko‘rinishida yozish mumkin.

3 - jadval. 0,4 kV iste’molchilar uchun quvvat koeffitsientini qiymatlari

Tok bo‘linish nuqtasi	R_{kun}/R_{tun}	cosφ	
		Kun	Tun
1	0.55	0,9	0,95
2	0.55	0,9	0,95
3	0.55	0,9	0,95
4	0.55	0,9	0,95
5	0.55	0.9	0.95
6	0.55	0.9	0.95
7	0.55	0.9	0.95
8	0.55	0.9	0.95

YUklamalar farqiga ko‘ra 1-liniyadagi tungi yuklamalar kunduzgiga qaraganda kattaroq. SHu sababli har bir iste’molchi uchun tungi yuklama va aktiv quvvat qiymatini topgan holda elektr sxemasi yana bir marta chiziladi.



10.2 – rasm. 1-liniyaning bir chizikli elektr sxemasi.

Elektr iste’molchilarning yuklamasini reaktiv quvat ko‘rinishiga keltirish uchun quyidagi formuladan foydalanish mumkin:

$$\sin\varphi = \sqrt{1-\cos\varphi^2}$$

Har bir iste’molchi ob’ekt uchun reaktiv quvat koeffitsienti qiymatlarini topiladi.

$$\sin\varphi_1 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0,95^2} = \sqrt{1-0,9} = 0,32$$

$$\sin\varphi_2 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0,95^2} = \sqrt{1-0,9} = 0,32$$

$$\sin\varphi_3 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0,95^2} = \sqrt{1-0,9} = 0,32$$

$$\sin\varphi_4 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0,95^2} = \sqrt{1-0,9} = 0,32$$

$$\sin\varphi_5 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0,95^2} = \sqrt{1-0,9} = 0,32$$

$$\sin\varphi_6 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0,95^2} = \sqrt{1-0,9} = 0,32$$

$$\sin\varphi_6 = \sqrt{1-\cos\varphi^2} = \sqrt{1-0,95^2} = \sqrt{1-0,9} = 0,32$$

Tarmoqdagi reaktiv quvvatli yuklama topiladi.

Buning uchun $\frac{\sin\varphi}{\cos\varphi} = tg\varphi$ tengligi asqotadi.

$Q_1 = P_1 \cdot tg\varphi = 3{,}06 \cdot \frac{0{,}32}{0{,}95} = 1{,}03\,\text{kVAr}$

$Q_2 = P_1 \cdot tg\varphi = 5{,}4 \cdot \frac{0{,}32}{0{,}95} = 1{,}82\,\text{kVAr}$

$Q_3 = P_1 \cdot tg\varphi = 5{,}4 \cdot \frac{0{,}32}{0{,}95} = 1{,}82\,\text{kVAr}$

$Q_4 = P_1 \cdot tg\varphi = 5{,}4 \cdot \frac{0{,}32}{0{,}95} = 1{,}82\,\text{kVAr}$

$Q_5 = P_1 \cdot tg\varphi = 5{,}4 \cdot \frac{0{,}32}{0{,}95} = 1{,}82\,\text{kVAr}$

$Q_6 = P_1 \cdot tg\varphi = 5{,}4 \cdot \frac{0{,}32}{0{,}95} = 1{,}82\,\text{kVAr}$

$Q_7 = P_1 \cdot tg\varphi = 5{,}4 \cdot \frac{0{,}32}{0{,}95} = 1{,}82\,\text{kVAr}$

1. Istemolchilarning to‘la quvvati hisoblanadi:

$S_1 = P_1 - jQ_1 = 3{,}06 - j1.03$; $S_2 = 5.4 - j1.82$; $S_3 = 5.4 - j1.82$; $S_4 = 5.4 - j1.82$ $S_5 = 5.4 - j1.82$; $S_6 = 5.4 - j1.82$; $S_7 = 5.4 - j1.82$;

2. Liniyalardagi ehtimoliy quvvatlarni topamiz:

$$\dot{S}_{A-1} = \dot{S}_1 + \dot{S}_2 + \dot{S}_3 + \dot{S}_4 + \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 37{,}8 - j11{,}95;$$

$$\dot{S}_{1-2} = \dot{S}_2 + \dot{S}_3 + \dot{S}_4 + \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 32{,}4 - j10{,}92$$

$$\dot{S}_{2-3} = \dot{S}_3 + \dot{S}_4 + \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 27 - j9{,}1;$$

$$\dot{S}_{3-4} = \dot{S}_4 + \dot{S}_5 + \dot{S}_6 + \dot{S}_7 = 21{,}6 - j7{,}28$$

$$\dot{S}_{4-5} = \dot{S}_5 + \dot{S}_6 + \dot{S}_7 + \dot{S}_8 = 16{,}2 - j5{,}46$$

$$\dot{S}_{5-6} = \dot{S}_6 + \dot{S}_7 + \dot{S}_8 = 10{,}8 - j3.64$$

$$\dot{S}_{6-7} = \dot{S}_7 = 5{,}4 - j1{,}82$$

3. Kuchlanish isrofining absolyut qiymatini topamiz:

$$\Delta U_{p.э.} = \frac{10000 \cdot 8.5}{100} = 850B$$

Rangli metalldan yasalgan o‘tkazgichlar $D_{o'rt.} = 1000$ **mm** bo‘lgan elektr tarmoqlarda induktiv qarshilik x_o = **0.36 - 0.4** Om/km bo‘lganligi sababli x_o = **0.4** Om/km qabul qilamiz.

4. Reaktiv qarshiliklar ta’sirida yo‘qotiladigan kuchlanish isrofini hisoblaymiz:

$$\Delta U_p = \frac{x_0 \cdot \Sigma \cdot Q \cdot \ell}{U_н} = \frac{0,4 \cdot (1,03 \cdot 0,2 + 1,82 \bullet 0,04 + 1,82 \bullet 0,08 + 1,82 \bullet 0,08 + 1,82 \bullet 0,08 + 1,82 \bullet 0,08 + 1,82 \bullet 0,08)}{10} = 0,098B$$

5. Aktiv quvvatdan yo‘qotiluvchi kuchlanish isrofini hisoblaymiz:

$$\Delta U_a = \Delta U_{r.e.} - \Delta U_{ish} = 850 - 0,098 = 849,9 \approx 850\ B$$

6. Elektr o‘tkazgich kesimini hisoblaymiz:

$$F = \frac{\Sigma \cdot P \cdot \ell}{\gamma \cdot \Delta Ua \cdot Uн} = \frac{3,06 \cdot 200 + 5,4 \cdot 4 + 5,4 \cdot 8 + 5,4 \cdot 8 + 5,4 \cdot 8 + 5,4 \cdot 8 + 5,4 \cdot 8}{32 \cdot 0,85 \cdot 0,4} = 78,08мм^2$$

Hisob ma’lumotlari asosida ichki qarshiligi ***r_o = 2,16 Om/km,*** ***x_o = 0,36 Om/km*** bo‘lgan standart kesimli alyumin-po‘lat simi **A 16** ni tanlaymiz.

Transformator podstansiyasining quvvatini aniqlash uchun liniyalar bo‘yicha umumiy yuklamani topamiz.

$$P_{TPkun} = P_{kunL1} + P_{kunL2} + P_{kunL3}=46.06kVt$$

$$P_{TPtun} = P_{tunL1} + P_{tunL2} + P_{tunL3=}77.1kVt$$

Transformatorning quvvati to‘la quvvatda bo‘lganligi uchun elektr iste’molchilarning aktiv quvvatdagi umumiy yuklamasini to‘la quvvatga aylantiramiz. Buning uchun quyimdagi formula o‘rinlidir:

$$S = \frac{P}{\cos\varphi}, кВА$$

Aktiv kuvvat koeffitsienti – ***cosφ*** ni topish uchun P_{kun}/P_{tun} ko‘rsatkichini topish so‘raladi.

$$P_{kun} / P_{tun} = 46.06/77.1=0.6$$

ko‘rsatkichi uchun ilovadagi 4 – jadvaldan ***sosφ*** qiymatini topamiz:

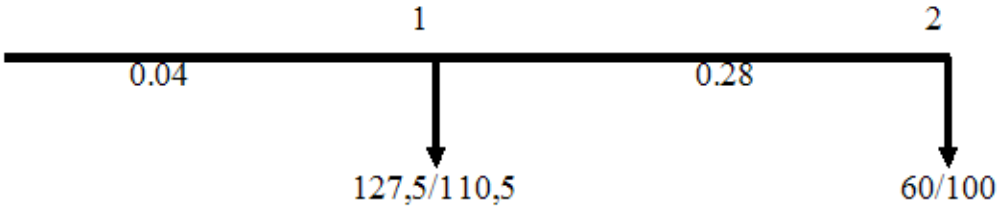
$$\boldsymbol{cos\varphi}_{kun}= 0,9 \qquad \boldsymbol{cos\varphi}_{tun}= 0,95$$

U holda: $$S_{кун} = \frac{P_{кун}}{\cos\varphi_{кун}} = \frac{46,06}{0,9} = 51,17кВА$$

$$S_{тун} = \frac{P_{тун}}{\cos\varphi_{тун}} = \frac{77,1}{0,95} = 81,2кВА$$

Ob’ektimiz uchun standart quvvatli TM100 moy transformatorini tanlaymiz.

TP4 L1



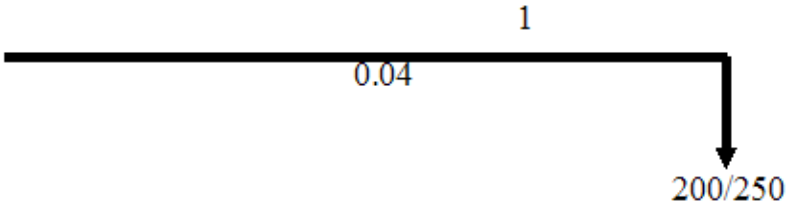
13-rasm. Bir chizziqli elektr hisob sxemasi

13-rasm asosida L3 dagi yuklamani hisoblaymiz

$P_{kunL1} = P_{1kun} + P_{2kun}$=127.5+60=187.5 kVt

$P_{tunL1} = P_{1tun} + P_{2tun}$=110.5+100=210.5 kVt

TP4 L2



14-rasm. Bir chizziqli elektr hisob sxemasi

14-rasm asosida L3 dagi yuklamani hisoblaymiz

$P_{kunL2} = P_{1kun}$ =200 kVt

$P_{tunL2} = P_{1tun}$ =250 kVt

Transformator podstansiyasining quvvatini aniqlash uchun liniyalar bo‘yicha umumiy yuklamani topamiz.

$$P_{TPkun} = P_{kunL1} + P_{kunL2} = 187.5+200=387.5 \text{ kVt}$$

$$P_{TPtun} = P_{tunL1} + P_{tunL2} = 210.5+250=460.5 \text{ kVt}$$

Transformatorning quvvati to‘la quvvatda bo‘lganligi uchun elektr iste’molchilarning aktiv quvvatdagi umumiy yuklamasini to‘la quvvatga aylantiramiz. Buning uchun quyimdagi formula o‘rinlidir:

$$S = \frac{P}{\cos\varphi}, кВА$$

Aktiv kuvvat koeffitsienti – ***cosφ*** ni topish uchun P_{kun}/P_{tun} ko‘rsatkichini topish so‘raladi.

$$P_{kun} / P_{tun} = 387.5/460.5=0.84$$

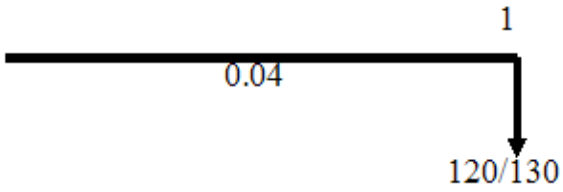
ko‘rsatkichi uchun ilovadagi 4 – jadvaldan ***cosφ*** qiymatini topamiz:

$$cos\varphi_{kun} = 0,8 \qquad cos\varphi_{tun} = 0,89$$

U holda: $S_{кун} = \frac{P_{кун}}{\cos\varphi_{кун}} = \frac{387,5}{0,85} = 455,8кВА$ $S_{тун} = \frac{P_{тун}}{\cos\varphi_{тун}} = \frac{460,5}{0,89} = 495,2кВА$

Ob’ektimiz uchun standart quvvatli TM630 moy transformatorini tanlaymiz.

TP5 L1



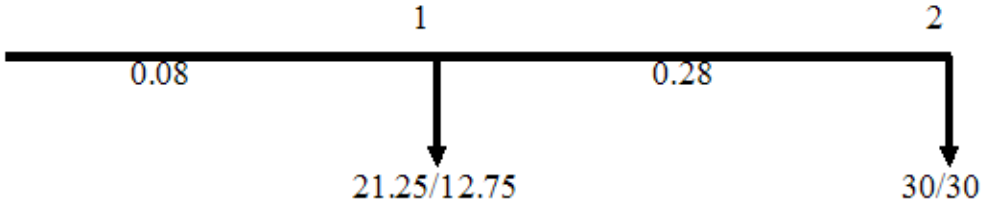
15-rasm. Bir chiziqli elektr hisob sxemasi

15-rasm asosida L3 dagi yuklamani hisoblaymiz

P_{kunL1} =120 kVt

P_{tunL1} = 130 kVt

TP5 L2



16-rasm. Bir chiziqli elektr hisob sxemasi

16-rasm asosida L3 dagi yuklamani hisoblaymiz

$P_{kunL3} = P_{1kun} + P_{2kun}$=21.25+30=51.25 kVt

$P_{tunL3} = P_{1tun} + P_{2tun}$=12.75+30=42.75 kVt

Transformator podstansiyasining quvvatini aniqlash uchun liniyalar bo‘yicha umumiy yuklamani topamiz.

$$P_{TPkun} = P_{kunL1} + P_{kunL2} = 120+51.25=171.25 \text{ kVt}$$

$$P_{TPtun} = P_{tunL1} + P_{tunL2} = 130+42.75=172.75 \text{ kVt}$$

Transformatorning quvvati to‘la quvvatda bo‘lganligi uchun elektr iste’molchilarning aktiv quvvatdagi umumiy yuklamasini to‘la quvvatga aylantiramiz. Buning uchun quyimdagi formula o‘rinlidir:

$$S = \frac{P}{\cos\varphi}, кВА$$

Aktiv kuvvat koeffitsienti – ***cosφ*** ni topish uchun P_{kun}/P_{tun} ko‘rsatkichini topish so‘raladi.

$$P_{kun} / P_{tun} = 171.25/172.75=0.99$$

ko‘rsatkichi uchun ilovadagi 4 – jadvaldan ***cosφ*** qiymatini topamiz:

$$cos\varphi_{kun}= 0,8 \qquad cos\varphi_{tun}= 0,89$$

U holda: $S_{кун} = \frac{P_{кун}}{\cos\varphi_{кун}} = \frac{171,25}{0,8} = 214кВА$

$$S_{тун} = \frac{P_{тун}}{\cos\varphi_{тун}} = \frac{172,75}{0,89} = 194кВА$$

Ob’ektimiz uchun standart quvvatli TM250 moy transformatorini tanlaymiz.

4. 35/10 kVli TP yuklamasini hisoblash.

S_{kunL1}= 275+(51.17+199.6) ·0.9=501kVt
S_{tunL1}= 333+(81.2+169.6) ·0.9=559kVt
S_{kunL2}=214+456·0.9=624kVt
S_{tunL2}=194+495.2·0.9=640 kVt

S_{kun}= S_{kunL1} + S_{kunL2} =501+624=1125 kVt
S_{tun}= S_{tunL1} +S_{tunL2} =559+640= 1199kVt

S_{kun}/ S_{tun}=0.93 $\cos\varphi_{kun}$=0.78 $\cos\varphi_{tun}$=0.87

S_{kun}=1125/0.78=1442.3 kVt
S_{tun}=1199/0.87= 1378kVt

Ob’ektimiz uchun standart quvvatli TM 1600 moy transformatorini tanlaymiz.

XULOSA

Suv ta’minotini va elektr energiyasi tejamkorligi kabi masalalar dolzarb bo‘lgan bir paytda bitiruv malakaviy ishinining bajarilishi maqsadga muvofiqdir. Biriruv malakaviy ishida qamrab olingan masalarning o‘rganish va echish asosnosida quyidagi xulosalarni chiqarish mumkin.

1. Kurs loyihasida qishloqdagi suv ta’minotini yaxshilash va elektr energiyasini tejash bo‘yicha tadbirlarni rejalashtirish va o‘tkazishda kelajakda yuzaga keladigan suv tankisligi va elektr energiyasi tejamkorligiga ijobiy ta’sir etadi.
2. Ob’ektdagi elektronasos qurilmalarini yangilariga almashtirish elektronasos qurilmalarining xizmat muddatini oshradi.
3. Nasos agregatlari yordamida chiqarilgan suv miqdori - 3878580 m^3 ga ortadi.
4. Iste’molchilariga uzutilgan suv miqdori – 2715006 m^3 ga ortadi.
5. Suv uchun iste’molchilardan undirilgan mablaŕ miqdori 1629006,6 ming so‘mga ortadi;
6. Elektr energiyasi tejamkorligiga erishiladi. Suv chiqarishdagi solishtirma quvvati sarfi 5,37 dan 3,11 ya’ni 2,26 kVt.soatgacha pasayadi.
7. Elektronasos qurilmalarining yangi va zamonaviylariga almashtirish suv tanqisligi muammosi dolzarb bo‘lgan hozirgi kunada masalaga echim bo‘la olishi mumkin.
8. YAngi elektronasos qurilmalari elektr energiya tejamkorligi va mablag‘ tejamkorligini ta’minlashi mumkin.
9. Elektronasos qurilmalarining zamonaviy Rodnik boshqaruv va nazorat qurilmalari bilan butlanishi avariya holatlaridan himoyadash va avtomatik boshqaruvning takimillashuvini ta’minlaydi.
10. Elektronasos qurilmalari va kuchlanishi 10/0,4 kV li transformator punktlarining yashindan himoyalash tizimini hisoblash ishonchlilikni ta’minlaydi.
11. Transformator punktlarini erlashtirish tizimining hisoblanishi nasos qurilmialaridagi emirilish, tokdan ta’sirlanish holatilarini bartaraf etib ishonchli erlatish tiziminit ta’minlaydi.

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MUNDARIJA

KIRISH.

1. Kuchlanishli 0,4 kV elektr tarmoqning yuklamasini hisoblash

2. Kuchlanishi 0,4 kV li havo liniya (HL)sini kesimini hisoblash.

3.Elektr tarmog'idagi yuklamani reaktiv quvvat bo'yicha hisoblash.

4. 35/10 kVli TP yuklamasini hisoblash.

5.Elektr tarmog'ini qisqa tutashuv toklariga tekshirish hisobi.

6. Yuqori kushlanishdan himoya tizimini hisoblash.

7. Yerlashtirish tizimini hisoblash.

8. Tehnik iqtisodiy hisob qismi.

Xulosa

Foydalanilgan adabiyotlar.